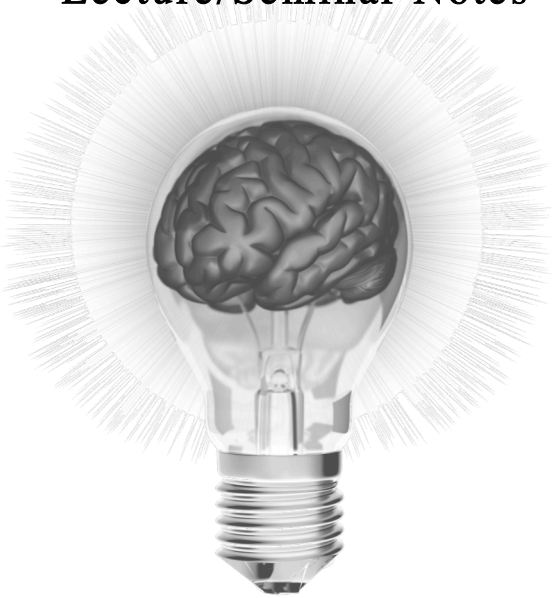
The Ecosystem of Learning…

…Anything

for all teachers

Lecture/Seminar Notes



Gregg Goodhart

The Learning Coach

www.ggoodhart.com

learningcoach@ggoodhart.com

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". . .optimizing instruction will require unintuitive innovations in how the conditions of instruction are structured."

-Bjork and Bjork (2011, p. 56)

How successful we are at *anything* we wish to do, from sports to arts to academics to life, will be determined by how well we *learn* to do that thing. Learning is indeed the most powerful and important piece to achieving whatever it is we wish to accomplish even if that is just improving a little bit.

It turns out that old sayings like, "Learning is power," that we've come to take for granted are actually, literally true. Being able to solve problems and take advantage of opportunities based on prior knowledge and skill is what determines our overall success in life from individuals to societies. Learning how to learn is the most important thing we can do for our own survival and success.

> Most people no longer live in villages, but in towns and cities. Away from the fields, streams and woods of the peasant village they live in environments almost entirely shaped by human activity. As different jobs and skills and forms of expertise proliferate *people spend more and more time learning. Information, expert knowledge, is what counts* rather than the generalized skills of peasants. Increasing numbers of people enjoy levels of nutrition and health that were rare even a century ago thanks to the productivity of modern agriculture and modern advances in medicine and healthcare. Modern anesthesia has ended the agony of most traditional medical interventions. No longer is an amputation or tooth extraction made easier to bear by nothing but a shot of liquor.
>
> David Christian, *Origin Story: A Big History of Everything*. (2018) Emphasis added.

"Learning how to learn is the ultimate survival tool."
(Bjork & Bjork, 2011. P. 63)

What Are Your Goals?

- To learn to teach well.
    - Teaching is something that if done poorly is barely done at all and can be potentially damaging to the development of a person. I know we are not paid like it, but we are as important as doctors. Think of it this way – someday your students are going to be in Congress making decisions about your retirement, important social and moral issues, or heck, just get along and get a few things done. Will you contribute to your student's growth in a way that supports them making the right decisions when it is time?
- Teaching is a no fail job.
    - Doctors, pilots, lawyers, etc.
- There is a lot here, but believe it or not this is just the tip of the iceberg. These are just jumping off points for more investigation, so as much as there is, there is much more to understand in order to implement. That is the teaching journey.

Teachers Change Brains with Surgical Precision, Literarily

Webster online

Full definition of surgery

1: a branch of medicine concerned with diseases and conditions requiring or amenable to operative or manual procedures.

- Teaching is tantamount to brain surgery. While it is quicker with a scalpel, we use cognition to change student's brains physically and/or functionally (neuroplasticity), and we do it in very specific ways depending upon the subject.
- We know how to build our muscles, and are not surprised when they change with exercise.
- It just takes a long time for the necessary large-scale neurobiological changes to occur. We easily accept this with our bodies. If someone decides to start working out and eating well we know that, over time, their body will gradually change. Even if they are very dedicated we know there will be little change in the short term. We don't think they lack 'muscle talent' when they don't get bigger right away.
- And that is just normal everyday life. Think about the level of training needed for the different levels of athletics. Now think of the cognitive training beyond regular competence for high educational performance.
    - BTW this is the exact model we use for giftedness education. Why should this be special?

Neuroplasticity/Learning Happens in Your Brain

- Neuroscience has improved dramatically over the last 30 years. The advent, and more importantly improvement, of fMRI (Functional Magnetic Resonance Imaging) as well as other diagnostic tools have pushed the field forward at an astonishing rate.
- It is enlightening the best cognitive/educational psychology has brought to bear since the middle of the 20th century or so (and more really). Seen as part of that big picture there are exciting things to learn about how we learn, and many of them are quite counterintuitive.
- Everybody has some of this, the great teachers have most of it, but few know the terms and how these concepts are organized as part of a larger model. This is because the research has only recently been disseminated and those of us who teach are, understandably, very far removed from the field of cognitive and behavioral psychology and neuroscience.
- Neuromyth

> The popularization of neuroscientific ideas about learning – sometimes legitimate, sometimes merely commercial – poses a real challenge for classroom teachers who want to understand how children learn. Until teacher preparation programs are reconceived to incorporate relevant research from the neuro and cognitive sciences, teachers need translation.. . . Meanwhile, the success of our schools will continue to be narrowly defined by achievement standards that ignore knowledge of the neural and cognitive processes of learning. . .these naïve misinterpretations of science have spread throughout the folk psychology of educators in recent years. . .The problems facing scientists and teachers are only exacerbated by the popular media, particularly those who sensationalize the, "Bold new findings," of scientists and exaggerate their immediate impact on society. . .An exchange of knowledge between neruo- and cognitive scientists and educators will help generate a better understanding of how learning takes place in real-world contexts." (Hardiman, Rinne, Gregory, & Yarmolinskaya, 2010. pp. 145, 157)

> *The need for translators* and for greater collaboration between educators and neuro- and cognitive scientists has been previously described by a number of researchers [Ansari and Coch, Fischer et al., Hinton and Fischer, Kuriloff et al., Ronstadt and Yellin]." "These translators, trained in multidisciplinary programs tied to school of education, can return to schools and school districts with sufficient background in the neuro- and cognitive sciences to provide perspective and transmit knowledge to their colleagues." (p. 157) emphasis added.

- Do we really only use 10% of our brains?

THE CAMBRIDGE HANDBOOK OF EXPERTISE AND EXPERT PERFORMANCE

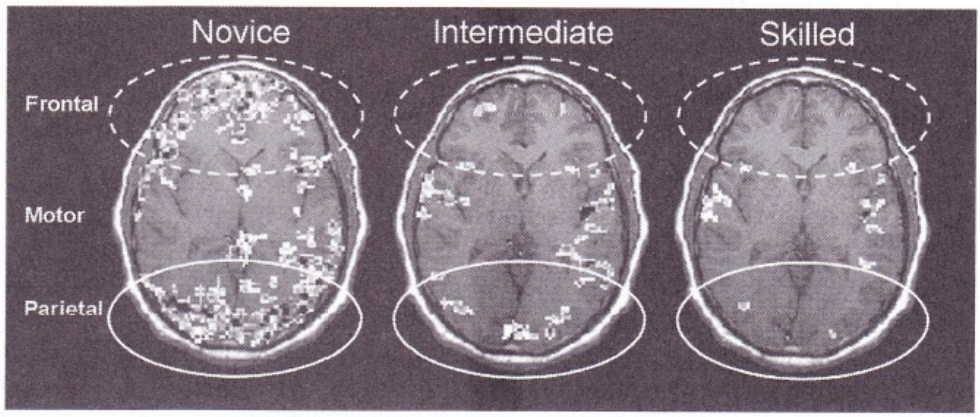
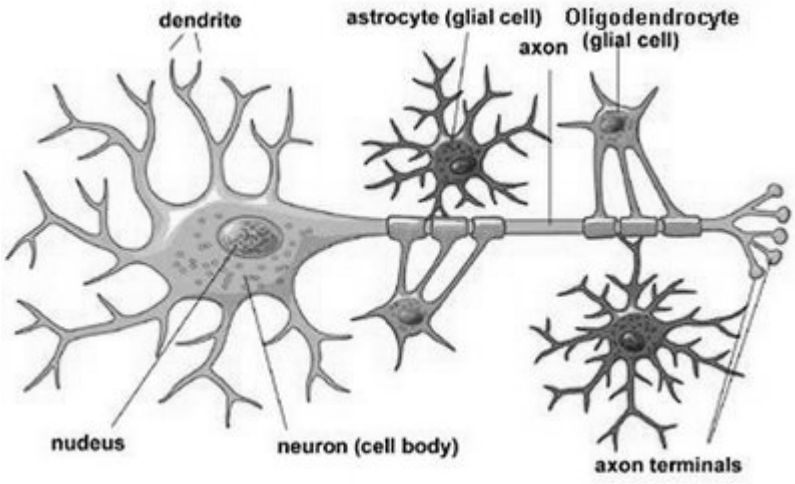


Figure 37.1. Activation of the brain, as a function of practice, in three periods of learning a motor tracking task. This is a maximum projection image, with white areas showing the activation of any cortical area either above or below the illustrated brain slice. The image is an axial (aerial) view of the head, where the top of the image corresponds to the front (nose) of the head and the bottom corresponds to the back of the head. The frontal areas (dashed ellipse) and parietal attention control areas (solid ellipse) show dramatic reductions in activation. The motor areas (middle of images) shares fairly preserved activation.

(Hill & Schneider, 2006, p. 656)

- Process Efficiency Change (Hill & Schneider, 2006) – less is more
    - During this process the brain is working through confusion to find the perfect efficiency point for that task (See the fMRI images on page 2). This occurrence has been called a process efficiency change.
    - At first the brain it is lit up like a Christmas tree. Most notably the pre-frontal cortex, responsible for executive function, is very involved. As the task is learned more and more regions drop out as the brain finds the perfect efficiency point for the desired ability. Here the skill can be reliably executed. This process involves difficulty and frustration as the brain is trying to figure out how to best deal with it.
- **Just as we can lift weights** in order to change and strengthen our muscles so too can we engage in exercises that physically and/or functionally change the brain. (Doidge, 2007)
    - Violinists left hand representations, London cab drivers Hippocampi. On and on.
- This is the idea of neuroplasticity. A concept that some still find hard to believe.
    - The book, *The Brain That Changes Itself*, (Doidge, 2007) follows the transition from the old thinking of specialization in the brain to our current understanding of how we can change it by the choices we make.
    - The old ideas that the brain is done evolving after childhood have been totally debunked. The brain is plastic for life.

- Training your brain - Everything we do or think is a neural representation in the brain. Neurons talking to other neurons. We have an estimated 100 billion neurons (give or take a few billion) that create more than 100 trillion connections.
    - Such communications are neural networks.
    - Synapses are gaps between neurons across which action potentials (electrochemical nerve impulses) travel.
    - Action potentials travel down an axon, which is punctuated by little gaps called the nodes of Ranvier.
    - Just as with the electricity we use, if the conduit is not insulated then the action potential leaks out and the signal is not as powerful (does not travel as fast). The more insulated the axon the faster it travels.
    - There are cells attached to axons called oligodendrocytes. Each time an action potential travels through an axon oligodendrocytes are activated to produce an insulating substance called myelin, which forms a covering known as the myelin sheath. (Araque & Navarrete, 2011; Wake, Lee, & Fields, 2011)

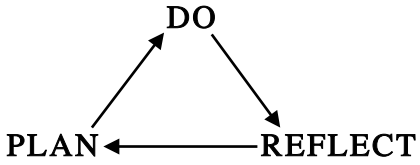


    - The more insulated the axon the faster the action potential travels (i.e. faster cognition, finger movements, etc.). That is why thoughtful repetition over and over creates solid technical foundation and speed *in all domains*.
    - Learning; slow accurate movements/thoughts create accurate neural representations ready for myelination.
    - Eventually (it takes some time) enough myelin accumulates for a process called saltatory conduction to take place. This change between the processes has been called the "Lillie Transition." (Young, Castelfranco & Hartline, 2013) In this process the action potential leaps across the axon at far greater speeds. Specifically it originates on both ends of the axon and meets in the middle instead of linear conduction from one end to the other.
        - Interestingly during the onset of the "Lillie Transition" action potential velocity decreases before the significant increase of saltatory conduction. This may explain plateaus in learning and why sometimes after working a lot on something we can seem to regress.

- We control our brains, how much we use them, and how we use them.
- At least 10 years and 10,000 hours to become world class in any complex domain, and that number is rising.
- The point is not to do 10 years 10,000, but to take the same steps as one would if one were to follow that process however many hours they may work to improve.
- There is always a way to improve whatever it is that is keeping you from improving. Getting better means solving the problem in front of you at any given time. Becoming great is just solving the problem in front of you hundreds or thousands of times. It is your choice how skilled you would like to become. Thank goodness there are teachers to help with that, otherwise it would take a lot longer to figure out how to solve those problems.
- The more problems we fix within a domain the better we get at fixing them in that domain (learning how to learn), and the quicker we get better at whatever it is we are trying to do.
- And that process is. . .

Deliberate Practice

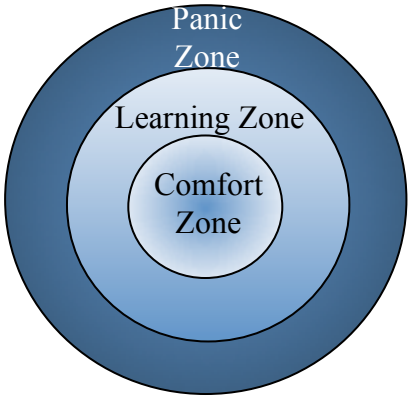
- Effortful activity generating constant feedback that guides the refinement of that activity over and over and over.
- The term first appeared in the 1993 paper, The Role of Deliberate Practice in the Acquisition of Expert Performance, published in *Psychological Review* by the leading researcher in skill development K. Anders Ericsson and some of his colleagues. (Ericsson, Krampke, & Tesch-Romer, 1993)
    - He refined and updated this in, "The Influence of Experience and Deliberate Practice on the Development of Superior Expert Performance." (Ericsson, 2006)



- Cognitive researchers have developed an inclusive model for the Plan-Do-Reflect model calling the three phases Forethought-Performance-Self Reflection, as well as addressing other environmental and psychological factors surrounding the paradigm of skill development. (Zimmerman, 2007)
- **"One characteristic of deliberate practice** is that it is not inherently enjoyable." (Ericsson, Krampke, & Tesch-Romer, 1993, p. 368)
    - It is work. Whereas physical work is taxing on the body, this type of intellectual work is taxing on the brain.
    - This state of difficulty is the 'sweet spot of learning'. I, half-jokingly, have called this the 'burn of learning' or the blearn – Feel the Blearn! Of course I later found it has a real name. Two UCLA researchers have described this condition as, "Desirable difficulty." (Bjork & Bjork, 2011, p. 58) Writing about the current

state of education professor Bjork states, "optimizing instruction will require unintuitive innovations in how the conditions of instruction are structured." (p. 56). Or to put it colloquially – learning is not what many people think that it is.

- Vygotsky and a version of the Zone of Proximal Development;



> . . .deliberate practice requires that one identify certain sharply defined elements of performance that need to be improved and then work intently on them. Examples are everywhere. . .Tiger Woods has been seen to drop golf balls into a sand trap and step on them, then practice shots from that near impossible lie. The great performers isolate remarkably specific aspects of what they do and focus on just those things until they are improved; then it's on to the next aspect." (Colvin, 2010, p. 68)

- **How most kids do homework is not deliberate practice**. No wonder classes seem hard. Kids who do all the assignments *as assigned when assigned* in their homework do not need to study for tests to get A's (rich mental model). I have known plenty of honors students who do this and it has everything to do with how they prepare not 'giftedness'.
- **While there are no shortcuts in learning, there are longcuts** and most people take those.
- Might that knowledge benefit you, or any students you know? If they are convinced of their own efficacy then how smart they are is entirely up to them.
- **Recovery Periods** and sleep
  - Engaging in deliberate practice is intellectually taxing (mental fatigue) and breaks need to be taken when serious confusion occurs.
  - Current research shows that world class experts cannot engage in more than 4-5 hours of deliberate practice daily (Ericsson, 2006). 90 continuous minutes of deliberate practice at a time seems to be the limit. Consider this if you want to introduce your students to this concept. Generally 45 minutes on and 15 minutes off works for high-level study. For beginners start with five minutes. This is far better than 15 minutes of unfocused work.

- When true mental confusion occurs, however long that takes, a recovery period is necessary.
- Leisure activity. (Ericsson, Krampke, & Tesch-Romer, 1993)
- Plan recovery periods.
- Research shows that high achievers take more naps (Ericsson, Krampke, & Tesch-Romer, 1993).
  - Memory is consolidated.
  - Recently it has been discovered that a 'sanitation system' called Metabolite Clearance that is not active during waking hours flushes out waste in the brain during sleep (Xie, et al., 2013).
- **Focus is like a muscle.** Those new to this type of intense concentration will only be able to lift a little intellectual weight until exhaustion. Start with little bits at a time, it will grow, but do not push through genuine mental fatigue. Take a break and do something that takes little intellectual investment.

- Repetition – I can't stress enough the importance of much of <u>thoughtful</u> repetition (did I do it right? If not how do I fix it? If I don't know ask my teacher, etc.) in the pursuit of effortless performance (critical thinking within the domain). Performing is fun, learning is work; the more work you'll do the more fun you'll have. The good news is we've got about 12 years of schooling to do this a little bit at a time.
  - Getting something 'right' is on only the *first* step. Then repetition can begin with an eye for anything that can be improved for each subsequent repetition. This process can take days, weeks, or months depending on the challenge.
  - It is fine to make mistakes. It is not fine to not recognize and correct them. Pay attention.
- Interestingly there is a way to supercharge the brain's learning potential. . .

<u>Distributed Practice/Contextual Interference/Retrieval Practice/Retrieval Structures</u>

- The Power Law of Practice (Newell & Rosenbloom, 1981)
  - Most progress is made during the initial stages then progress slows, sometime to a halt (plateau) for a while and the last stages take a long time.
- "The Strategy Specific Nature of Improvement: The Power Law Applies by Strategy in Task," (Delaney, Reder, Staszewski, & Ritter, 1998).

> Several authors have shown similar effects of strategy changes on young children's arithmetic. For example, Siegler and Jenkins (1989) used concurrent verbal protocols and videos of young children who knew how to add using a simple counting-from-one rule. After 11 weeks of practice, almost all of the children had learned a more efficient rule that involved counting up from the larger addend rather than counting up from one. Children using this more sophisticated counting rule were faster at solving the problems because they had many fewer operations to perform to produce the answers. In summary, several studies in the domain of

arithmetic problem solving indicate that strategy shifts occur along with improvements in solution times. (p. 2)

  - A brain imaging study (Song, Buch, & Cohen, 2011) identified that practice under these types of random conditions produces activity in regions connecting the sensorimotor cortex to part of the brain consistent with increased training (posterior putamen) *early in the training process.*
  - Varied repetition; the power law can be reset so that initial fast gains occur again by working on the same material in new ways.
  - Take Ben Franklin and writing. He learned to be a great man of letters through an ingeniously designed set of varied repetition.
  - This is present in all high efficiency/high level teaching and coaching.
- Don't just try these once or twice. Don't give up on new ideas too soon. Some of these will work better than others in certain situations. After you begin using them for a while you will be able to identify the strategy best for specific circumstances. In any case, doing any of this will work much better than doing none.
- Daniel Coyle (2007), *The Little Book of Talent.*
  - Great ideas for the practical application of strategies applicable to any domain.

Contextual performance is different than practice.

- Practice – isolating and working on small areas over and over, applying things like contextual interference to increase facility. This uses working memory, which holds about 7-9 pieces of information at any given time. Our corrections and improvements are informed by our recent memory of what we just did.

- Contextual performance – Such as a test or having to use the information in real time to solve problems/perform in a game (critical thinking) "Do or die, one and done," type situations. This requires accessing information from long-term memory in working memory, which can be practiced for greatly increased speed, accuracy and volume. This can be where testing and performance anxiety originate. What seemed easy to remember in the moment while we held it in working memory in practice seems 'forgotten' when we have to access long-term memory in the moment of performance.

The following learning interventions are related and sometimes intertwined; there are elements of some within others. The owner's manual for distributed practice strategies like this is the book, *Make it Stick*, (Brown, McDaniel, Roediger, 2014) and it can be layered on to any teaching you are already doing. I cannot recommend this book highly enough, though it is a bit advanced.

Two other researchers who have done a significant amount of work in this area are Robert and Elizabeth Bjork at UCLA. Their, "Learning and Forgetting Lab," has an online presence with resources for understanding these concepts and their important and fascinating research.

Random Practice and Varied Repetition

- Creating certain difficulties in the learning process increases retention and retrieval.
    - Word problems in math.
    - Low stakes quizzes/tests given randomly to take advantage of the testing effect.

> Taking a memory test not only assesses what one knows, but also enhances later retention, a phenomenon known as the testing effect. We studied this effect with educationally relevant materials and investigated whether testing facilitates learning only because tests offer an opportunity to restudy material. . . . prior testing produced substantially greater retention than studying, even though repeated studying increased students' confidence in their ability to remember the material. Testing is a powerful means of improving learning, not just assessing it. (Roediger & Karpicke, 2006, p. 249)

    - Batting practice study (Hall & Cavazos, 2004) 30 male baseball players from a junior college baseball team ranging in age from 17 to 21 years, with an average of 9.5 years of experience in competitive baseball. In batting practice some saw pitches in blocked presentation and the others in random. Initial performance during practice showed less improvement for the random group, but after 6 weeks that groups improved by 56.7%(!) while the blocked group improved 24.8% and a control group only 6.2%.
    - Brain dumps.
    - Many possibilities

Retrieval Structures

- A good memory can be trained, and is not an inborn gift.
    - Dual coding
    - Mnemonic devices
    - Chunking

Elaboration

- Taking the plan-do-reflect model of deliberate practice and discussing and refining how what you are learning might relate to other areas/situations/uses/contexts No idea is unreasonable. Refine it from there.

Spacing

- The spacing effect is "a case study in the failure to apply the results of psychological research." And this refers to research that has been available since the late 19th century. "The spacing effect was known as early as 1885 when Ebbinghaus published the results of his seminal experimental work on memory" (Dempster, 1988, p. 627).
    - What else have we been missing?
- Putting periods of forgetting in between retrieval to strengthen availability in contextual performance.
    - Plickers
    - Leitner system
        - Anki flashcard app
    - Low stakes quizzing/testing
- This technique is so unusual and frustrating that even when students experience the benefits many will choose to go back to older less efficient ways of learning.

Interleaving

- Similar to spacing, but different. Spacing can occur over hours, days, weeks. Interleaving occurs within single sessions by regularly switching what we are working on.
- Conventional wisdom is that working on something doggedly for long periods of time is the best way to learn/improve. One reason for this is the presence in working memory of whatever information is needed to improve the next phase. The goal, however, is to get this information into long-term memory so that it is permanently present.
- Research shows that moving on to a new task *before* something feels comfortable achieves this. For instance, don't work on your math homework for 30 minutes then history for twenty. Do math for three 10 minutes sections with 10 minutes of history in between each.
- The reconstitution or relearning of what you learned during the last section has powerful lasting effects for learning.

The idea with spacing and interleaving is that long-term strength of learning is increased if short-term learning is made to be more confusing/challenging *in specific ways. It is important to note that everything that makes learning more confusing is not beneficial, and things that might not be beneficial at one stage of learning may be beneficial at others. Navigating this is the high art of teaching.*

- If used correctly learners will actually appear to do worse in their learning at first, and this applies to many of these learning interventions. This is part of the process and what

one researcher identifies as one of the most significant fallacies in learning. Professor Robert Bjork describes this in a podcast.

> . . .to the degree you interpret current performance as a valid measure of learning you will do all sorts of things wrong as a teacher, as a student managing your own studying, in terms of judgments you make about whether you can stop studying, to keep studying, what you should study. All of those things are kind of at risk so to speak if you interpret your current performance as learning. (Kime, 2018, 28:58)

- Are you starting to see that. . .

Talent is Overrated

- If talent exists, and it may, research shows that it does not seem to matter.
- Consider how important, or not, this concept is to you.
- It is the subject of an excellent book that delves into the complex issues surrounding skill development. In *Talent is Overrated* Colvin (2010) writes,

> If it turns out that we're all wrong about talent-and I will offer a lot more evidence that we are-that's a big problem. If we believe that people without a particular natural talent for some activity will never be very good at it, or at least will never be competitive with those who possess that talent, then we'll direct them away from that activity. We'll tell them they shouldn't even think about it. We'll steer our kids away from particular studies whether they're art, tennis, economics or Chinese because we think we've seen signs that they have no talent in those realms . . . most insidiously, in our own lives, we will try something new, and finding that it isn't easy for us conclude that we have no talent for it, and so we never pursue it. Thus, our views about talent, which are extremely deeply held, are extraordinarily important for the future of our lives, our children's lives, our companies and the people in them. Understanding the reality of talent is worth a great deal.
> (p. 20)

- The Role of Practice in the Development of Performing Musicians. (Sloboda, Davidson, Howe, & Moore, 2011)

> A sample of 257 young people aged between eight and 18 who had undertaken individual instrumental tuition were interviewed in depth about their performing history from the start of playing. A subset of 94 of these individuals also kept a practice diary for a 42-

> week period. The data collected allowed estimates to be calculated of the amount of time devoted to various types of practice and other activities. The sample was selected in order to encompass a wide range of levels of musical achievement, from pupils at a highly selective specialist music school through to individuals who had abandoned instrumental study after less than a year of formal instruction. Data about formal examination successes confirmed the very wide range of achievement in the sample. It was discovered that there was a strong relationship between musical achievement and the amount of formal practice undertaken. Weaker relationships were discovered between achievement and amount of informal playing. There was no evidence that high achievers were able to gain a given level of examination success on less practice than low achievers. High achievers tended to be more consistent in their pattern of practice from week to week, and tended to concentrate technical practice in the mornings. These data lend strong support to the theory that formal effortful practice is a principal determinant of musical achievement. (p. 1647)

- Mozart and Tiger Woods explained (Colvin, 2010).
    - Children of motivated master teachers.
    - Put in thousands of hours of guided practice starting at a very early age.
    - The Rochlitz letter
    - There is no magic here other than the unusually young age they started focused, guided, serious work with excellent coaching.
- The misunderstanding of talent can happen right under our noses, and not be noticed. Yo-Yo Ma's ma. Despite enormous environmental prompts and advantages she has no idea from where he got his capacity to learn music. (Shenk, 2010)
- My Twinkle story.
- IQ, short of developmental disability, does not seem to matter.
    - High achieving populations were studied and their IQ scores were similar to lesser achieving populations. What is more is that the higher achieving population was slightly lower on average, though they do show up more at both the upper and lower extremes. Many elite jobs held by the high achievers hold a minimum threshold of an IQ of 103, while for those in lower achieving populations that threshold it is above 110. (Baumeister & Tierney, 2011).
    - James Flynn and his population IQ research. How can IQ across populations reliably rise whenever an area becomes industrialized if it is a fixed factor? IQ, short of developmental disability, does not seem to matter, and you can build it.
- Are kids encouraged because they are talented or talented because they are encouraged?
- It can even be detrimental to believe in talent. (Dweck, 2006)
    - *The Dangers of Believing That Talent Is Innate.* "A study of academia shows how being convinced of intrinsic ability may lead to bias and unwillingness to

change." (Gopnik, 2015). Changing/making corrections is an indispensible part of learning.

> . .child achievers are frequently hobbled by the psychology of their own success. Children who grow up surrounded by praise for being technically proficient at a specific task often develop a natural aversion to stepping outside their comfort zone. Instead of falling into a pattern of taking risks and regularly pushing themselves just beyond their limit, they develop a terrible fear of new challenges and of any sort of flaw or failure. Ironically, this leads them away from the very building blocks of adult success. "Prodigies [can] become frozen into expertise," say Ellen Winner. "this is particularly a problem for those whose work has become public and has won them acclaim, such as musical performers, painters, or children who have been publicized as 'whiz kids'. . .It is difficult to break away form 'technical' expertise and take the kinds of risks required to be creative." (Shenk, 2006, p. 75)

- At least10 years and over 10,000 hours to become world class in any complex domain, and that number is rising.
- The point is not to do 10 years 10,000, but to take the same steps as one would if one were to follow that process however many hours they may work to improve.
- There is always a way to improve whatever it is that is keeping you from improving. Becoming great is just solving the problem in front of you thousands of times, and becoming better is just solving the one in front of you at any given time. Thank goodness there are teachers to help with that, otherwise it would take a lot longer to figure out how to fix those problems.
- The more problems we fix the better we get at fixing them (learning how to learn), and the quicker we get better at whatever it is we are trying to do.
- So, if all of the previous turns out to be true then what stands in the way of anyone, really everyone, being really great at whatever they choose? It turns out it is. . .

Self Control

- Also called executive function by neuroscientists and self-regulation by psychologists. Many people call it willpower. This refers to the basic ability to choose "should" over "want".
- This is wired up in the pre-frontal cortex of the brain.
    - The PFC is very underdeveloped in the young and will not finish developing until the age of 25 (ever wonder why your insurance goes down, or you can't rent a car until you are 25?).
    - Self-control is learned just like instrumental skills – we engage in the behavior (create the neural network) and then reinforce it by repeating it over and over (myelination).

    - Because this control of impulse is unpleasant for a young person, and indeed many people, many times they have to be taught, and sometimes structured into these behaviors. It takes a good deal of self-control on the part of parents and teachers to make children do things that appear to make the child uncomfortable in the interest of making them self-reliant adults. That is one of the greatest acts of love we can do for a child: not praising them effusively for doing nothing or being their friend.
    - We have a limited amount of this resource, but with work it can be increased as *generic willpower*, that is to say that they can be used to make yourself do any number of things you may not feel like doing. (Baumeister & Tierney, 2011)
- Habit pattern development. Practicing, and doing work properly, can be developed incrementally into a habit. (Duhigg, 2012; Baumeister & Tierney, 2011)
- Self-esteem movement of the 70's, 80's, 90's
    - Studies show self-esteem correlates with good grades (self-control) (Baumeister & Tierney, 2011)
    - Educators and others believe that praising children for nothing (everyone gets a first place trophy!) will impart self-esteem thus facilitating better grades.
        - Yet this does not identify the causal factor. Why believe that self-esteem leads to good grades *when it could be that good grades lead to self-esteem,* and that is indeed what later research found, and it seems this movement is coming to an end. However many of our children have been raised to some degree to believe they are superstars for doing nothing, and expect to be treated that way. They have underdeveloped pre-frontal cortices and in severe cases are living with their parents as adults *with no intention of accomplishing anything else.* They may expect their parents to treat them a certain way, but that is not going to work with society at large.
    - Researchers ran with it with one in 1994 praising it in the news. What did not make news was the end of his report in which he said it was,

      > . . .disappointing" to see the lack of really solid evidence "to date." (Smelser, 1989, p. 1) But better results were expected once more work was done. . .The studies were continued, and eventually another institution commissioned another report. This time it was not a political unit, like the state of California, but a scientific body, the Association for Psychological Science. . .(They) sifted through thousands of studies looking for the ones that met high standards of research quality. The panel found several hundred like the one that tracked high school students for several years in order to understand the correlation between self-esteem and good grades. . .It turned out that grades in tenth grade predicted self-esteem in twelfth grade, but self –esteem in tenth grade failed to predict grades in twelfth grade. Thus it seemed, the grades came first, and the self-esteem came afterward. (Baumeister & Tierney, 2011 p. 190)

    - Search, "You Can do Anything," a Saturday Night Live sketch for a funny view of this phenomenon (rated TV 14). After you laugh you may cry when you realize how accurate it really is.
- Misunderstanding and oversimplifying a complex idea like mindset.
    - At the beginning of chapter 3, *Working Together*, Earl Woods (1997) he includes writes the following: "Fun, Competition, Opportunity, Concentration, Humor, Patience, Positive Attitude."
        - Exaggerating the significance of some of these while dismissing others to make it fit a personal belief system is not effective. Do some people just hear the words, "Fun, humor, positive attitude?"
        - What do these words really men in context?
- Efficacy of self-discovery learning vs. explicit instruction is not either or, but an art form.
- Creating motivation without failure.
    - This world does not exist (mindset), however there is much that can be done to reduce the negative and produce lasting positive habit patterns.

Habit Pattern Development

- Doing work properly, can be developed incrementally into a habit. (Duhig)
- Some research indicates it takes 30 days to build a solid habit, (Coyle) Some estimate a bit shorter, or up to six weeks, but these can be built through training (initial learning, then repetition).
- We are working on two things here: *amount* of work and *type* of work (as discussed earlier). Both can be trained simultaneously. Both are like muscles and can be developed as one would develop a muscle. Start with a little resistance and increase as strength increases.
    - Amount of work:
        - Selective attention (Stevens & Bavelier, 2012) and its orientation.
        - Fill out a time inventory (see attached time inventory sheet) and find 'sacred' work time.
        - We are working on getting started, quit without guilt. Identify the smallest details and begin building from there.
        - Start with 10 minutes 5 days a week. After two weeks it will begin to become a habit. That is to say that the act of getting started and going through the first 10 minutes is like tying your shoes. It may not be pleasant, but it is just something you do automatically without any significant discomfort.
        - Go to 15-20 for the next two weeks. The student can quit without guilt at 15. All I ask is that they *try* to push through for another minute. If not right away then eventually they will go past that without even noticing.
    - Type of work. Focus; what it is and how to train it:
        - Start with a little. Choose a task and pay attention to detail, the smaller the better. Follow the Plan-Do-Reflect-Plan model from the Deliberate Practice section for every move or step you take. This will become uncomfortable

after a few minutes. Stop and continue practicing as you used to until you feel you can focus that hard again. When ready do a few more minutes. Keep doing as much as you can each practice. It will become easier and increase over time.

- What many people think is focus and work toward improvement is not. Thus significant improvement is rare. Getting work off of one's desk is much different than getting the work done right which is the essential concept of skill development.
- Attention to every detail, the smaller the better – build up from there.
- **Endeavor to not give answers when possible**, ask questions to let students find the answers. This is harder than just giving information and is a mark of master teaching. If you are new to doing this it will be a bit confusing and mentally uncomfortable. You are going through desirable difficulty (Feel the Blearn!), don't abandon it, embrace it.
- Meta coaching.
- 10x perfect game.
- What if. . .
- I'm going to ask you to perform a task and pay attention to yourself and anyone else involved. When you we finish this section be prepared to speak for 2-3 minutes about every aspect of everyone's performance. This brings the student to acute awareness paying attention to as many details as possible in order to fill the time (I usually start by becoming totally silent for 30 seconds. It seems like an eternity and then I tell them I'll want them to fill at least four times that amount with their critique). I do not make them speak, but they always perform better on that attempt and learn what good focus is.

- Unfortunately many of us go about learning with an inefficient. . .

Mindset

- Researcher Carol Dweck. (2006)
  - Her three decades plus of research has addressed **why**, to put it colloquially, **most of us can't get out of our own way when it comes to learning**.

Much of following, through 'Dan Snyder', was taken from a *Revisionist History* podcast episode. (Gladwell, 2016) Some of the stats were corrected using basketballreference.com.

- Wilt Chamberlain, Hall of Fame NBA player, still holds the single game scoring record with a 100 point game at the end of the 61-62 season. 50% free throw shooter before this year, his career best at 61.3% (16 year career average 51% with many years in the 40's). 28 out of 32 at the line, 87.5% in the 100 point game.
  - Teammate Rick Barry (Career FT 89.3% [94.7% in 74-75]. Over 90% 8 out of 10 seasons with one other being at 89.9%) Wilt modeled his free throws on Rick, and shot a career-best 61% from the line in 1961–62 ups from 50% the previous year. And that was just the beginning.

- Rick Barry would miss 9-10 FT per season, LeBron typically misses about 150. **How did he do it?**
- Barry explains that his technique improves shooting from the line for big men. Softer hands on free throws, more 'bad' shots go it. If you are offline it is more forgiving.
- What did Chamberlain do? Shot underhanded, 'granny style', between his legs.
- So, he had a problem, tried a solution and it worked so well that he set an all time record, then stopped doing it. Barry says – he could have been way, way better.
- He had every incentive to continue. He improved from 50% to 61% in just the first season he started working with the technique, and the 100-point game was at the end (of course!).
- He never shot free throws that way again. According to Wilt in his autobiography.

> I felt silly like a sissy shooting underhanded. I know I was wrong (emphasis added), I know some of the best foul shooters in history shot that way. Even now the best one in the NBA, Rick Barry, shoots underhanded. I just couldn't do it."

- Barry approached Shaquille O'Neal, a career 52% free throw shooter, and offered to teach him how to improve. According to Barry, O'Neal said, "I'd rather shoot zero than shoot underhanded." What if Shaq shot 80%. Think of that career. And why did it not happen?
- Barry worked with a modern NBA guy who got it down, then never had the nerve to use it. Barry will not give his name so as not to embarrass him!
- What is there to be embarrassed about? Being great?

- Barry's dad told him in high school to shoot underhanded. He was already about 70%. He did not want to do it – Dad their going to make fun of me. "Son, they can't make fun of you if you're making them." He did it and in the first game on the road a guy in the stands yells out, "Hey Barry you're a big sissy shooting like that." They guy next to him says, "What are you making fun of him for he doesn't miss."
  - There is always a solution. Do we always pursue it?
- Taught NFL Dan Snyder early in his career about the relative value of draft picks and he was enthusiastic, and then did the opposite in the draft.
- Dominick and nails.
- It is important to understand that we sometimes evaluate and decide to use information based on unreasonable emotional evaluations. Like Wilt we may know we are doing it, but do it anyway. That is a choice, and how much we improve will be significantly affected by how you deal with this.
- This is the teaching of 'buy-in'. It is hard to get full focus if the student does not truly believe that what they are doing will pay dividends, and not only will it pay dividends every time, but learning will become more and more fun as one gets better and better if effective teaching is happening (see the rest of this document for that). At every moment

of frustration, or every rejection of something as 'stupid' point out that is just part of the process. It is OK to feel bad, now on to the fixing it in a way we know will work - mindset. Time to improve!

- What if you were just a small tweak away from upping your skills like that?
    - **You are.**
- Growth vs. fixed mindset
    - See attached handout
- How do most of us deal with failure/mistakes during the learning process?
    - Why are mistakes a problem, and why should they make us upset? They are instead opportunities to learn what not to do, just pieces of information for the reflect and plan pieces of deliberate practice that move us closer to better and better performance.
    - Once, after his college team lost the last game of the season Michael Jordan went and practiced his shots for hours.
- Two in-game broadcasters, Len Kaspar and Jim Deshaies (2019) talking about MLB all star Javier Baez:

> Len Kaspar: I was talking to somebody about Javy the other day, how free and easy he is and how mistakes don't compound. Make a bad error, have a bad strikeout, have a bad *swing* and it never seems to affect him negatively on the next swing or play. That's a skill. . .He is the kind of guy, in a complimentary way, teammates can get frustrated with him because they get anxious and stuff bothers them, and they can make two to three errors in a game. They wonder how it can't happen to him.
> Jim Deshaies: Yeah, he has ability to kind of put things behind him in a hurry.
> Len Kaspar: It's so instructive, but it's impossible to teach. It's what makes him so great.

        - He is right about how game changing this skill is in performance, but how does he know it is impossible to teach? It is the teaching of mindset.
    - Decision fatigue. (Baumeister & Tierney, 2011)
    - Praise the work, not the 'talent'. This is simply the truth and not a manufactured motivational strategy.
    - Perseverance/patience not only with the skill at hand, but also learning the skill of mindset.
        - Setting goals is good, setting deadlines may not be.
- **There are wrong answers**, and we do a service to students when we allow them to face failure and solve these relatively small, relatively uncomfortable problems to build the skills of adult self-reliance. Are they really that fragile? Not with the right mindset.
    - Childhood setbacks

    - People and their words. . .
        - https://youtu.be/hSp8IyaKCs0?t=10
        - Honesty in assessment – critical feedback for formative assessment in learning
- Aren't we called to be their mentors, and not their friends?
- Don't believe the road signs that nature puts up along your quest for skill development.
    - Research shows that there is no fast track to improvement. Level of accomplishment always correlates with amount of practice.
    - Don't measure yourself against where you want to be, measure yourself against where you have been, and how you have improved over the course of months, at least.
        - That is not to say one should not hold in their minds, and observe in life, examples/visions of what one wants to strive toward. Having these models is especially important if high-level skill acquisition is the goal. (Ericsson, 2016)
    - Don't compare yourself to others by age. Compare by hours put in and, more specifically, the type of work done during those hours.
    - How progress is measured. Days vs. weeks or months. The long arc of performance development.
- **Skill acquisition is set up backward** to what most people perceive it should be. Many perceive that because something is hard at first and little progress is made with great effort that they do not have talent. In reality it is pushing through this initial phase and getting to a level of competence in which higher-level accomplishment can be trained *is itself* 'talent'. Many tend to think that being really good at something right away (which never happens, the research is overwhelming on this) reveals a 'talent' and then hard work to reach one's potential can begin. This is part of the misunderstanding of talent.
- **So how are we** supposed to get students to push through this and get to the point where their rich mental models make learning robust and fun? Why not try. . .

Real Accomplishment as Motivator

- We cannot get there without pushing through the initial learning (The Blearn, motivation, allocation of time, acquisition of instruction, etc.) just like your muscles would be sore and you would hurt for a while if you started working out, the brain will 'hurt' as one engages in meaningful skill acquisition. It is a myth that any given individual begins learning a skill *with no previous exposure or participation in that domain* significantly faster than anyone else.
- Development and Adaptation of Expertise: The Role of Self-Regulatory Processes and Beliefs by Barry J. Zimmerman (2006)
    - Using several domains this research showed that genuinely getting better (good) at something through proper training created a genuine interest in participating in *and improving* in a given domain. "Because successful learners view strategic processes as effective means to an end, they are motivated more by the attraction

of positive outcomes of these processes than by the fear of adverse outcomes (Pintrich, 2000)," (p. 709)
    - This is the source of real self-esteem and self-efficacy.
    - Passion can be developed and nurtured. Could all passion for life pursuits come from here?

Flow

- The good news is that it appears the brain is designed to crave high level problem solving/cognition, after all that is how humanity has advanced over the course of time, but the price of this productive state of enjoyment is persevering through the initial unpleasant stages.
- This is the work of Mihalyi Csikszentmihalyi (2003) who has devoted his career to explaining that state of losing ourselves in a challenge, time melting off the clock, and much being accomplished. This is what some people refer to as the 'zone'.
- It is a real psychological phenomenon, and it appears that this is the highest state of efficiency at which we can function.
- The mental state of operation in which a person performing an activity is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity. In essence, flow is characterized by complete absorption in what one does, and a resulting loss in one's sense of space and time.
- If the task is too easy we will become bored If the task is too difficult we will become frustrated.
- When high ability meets a higher challenge we lose ourselves in the challenge and time melts off the clock. This is the most efficient way to coach and design lessons.
    - When it happens write it down!!
    - Keep asking questions and redirecting focus – every second (though don't forget about the importance of recovery periods. A little silliness for a minute will usually do the trick. After some intense work I might say, "Now would you please recite the Gettysburg Address . . . backwards . . . and in Latin." Clear the mind, reset, and begin again).
- He makes a distinction between enjoyment (when the brain is stimulated and we are in flow) and pleasure (lying on the beach, watching TV, etc.).
- This is the state we all strive for, but we do not know that as beginners. This applies to everything we do (general learning theory).

Teaching Creativity at the Atomic Level

- Creativity, as most experience it, is a performance of intelligence.
    - "Creativity is intelligence having fun." - Albert Einstein
    - Big C, little C and mini C creativity (Colvin, 2010)
- In this brand new age of globalization there will always be someone somewhere who is willing to manufacture something more cheaply than we can in America and maintain the expected quality of life. Former Federal Reserve Chairman Alan Greenspan (2007) wrote of this;

> Manufacturing jobs can no longer be highly paid, since it is consumers who at the end of the day pay the wages of factory workers. And they have balked. They prefer Wal-Mart prices. Those prices, reflecting Chinese low wages, are inconsistent with a funding of high-wage traditional U.S. factories. Forcing U.S. consumers to pay above-market prices to support factory salaries eventually would run into severe resistance. But by then, the American standard of living would have fallen." (pp. 395-396)

- "In a world of forces that push toward the commoditization of everything, creating something new and different is the only way to survive. A product unlike any other can't be commoditized." (Colvin, 2010, p. 146)
    - ". . .too many of our students languish at too low a level of skill upon graduation, adding to the supply of labor in the face of an apparently declining demand." (Greenspan, 2007, 399-400)
- Take Apple – created here, made there.
- There has been a push to teach creativity in schools for some time. Sometimes with disastrous results.

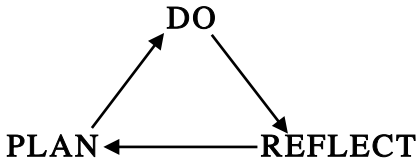
> In 1989 the National Council of Teachers of Mathematics, ". . . report recommended a curriculum that dropped emphasis on basic math skills (multiplication, division, square roots, and so on) and pressed students to seek more free-flowing solutions and to study a range of special math topics. I always wondered how you can learn math unless you have a thorough grounding in the basics and concentrate on a very few subjects at a time. Asking children to use their imagination before they know what they are imagining about seemed vacuous to me. It was." (Greenspan, 2007, p. 406).

    - They have since reversed that position.

> . . .cognitive load theory suggests that the free exploration of a highly complex environment may generate a heavy working memory load that is detrimental to learning. This suggestion is particularly important in the case of novice learners, who lack proper schemas to integrate the new information with their prior knowledge." (Kirshner, Sweller, & Clark 2006, p. 80)

- And this about where we currently stand when it comes to teaching creativity in most subjects. How, then, should we do it?
- The first thing we should understand is exactly what Greenspan was addressing – How can you create in a domain without requisite knowledge?
    - ". . .the epistemology of a discipline should not be confused with a pedagogy for teaching or learning it. The practice of a profession is not the same as learning to practice the profession." (Kirshner, et al., 83)
    - Do what they did, not what they do.

- The President's Committee on the Arts and the Humanities. (2011)
    - ". . .the approaches used in teaching the arts are very compatible with the development of balance among the three types of abilities associated with creativity as described in a well-known theory of creativity development:
        - **synthetic** ability or generating new and novel ideas;
        - **analytic** ability or critical thinking which involves choosing which ideas to pursue; and
        - **practical** ability or translating ideas into action (Sternberg & Williams, 1996)."(pp. 38-39)
    - Does this sound familiar?



- Manipulate basic information using strategy changes to apply deliberate practice at the earliest stages and reinforce to students, and everyone else for that matter, that they are learning the very beginning stages of high level creative thought.
- Teaching creativity at the atomic level. The creative process is present in the steps involved in deliberate practice.
    - **Plan** - Even the most rudimentary solution, even a wrong one that the student should be guided to understand was wrong in the reflect stage, is problem solving which is separate from problem discovery. This is the exercise of rudimentary creativity. – generating an answer that was not there before. The continued refinement of those answers over time is the refinement of the creative process.

- Reflect – This is the act of critical thinking. This can be done with the young, though they need to be scaffolded in the problem discovery process. In a 1987 study on that issue researchers found, "These results suggest that problem discovery is associated with creative performance in adolescents. . .This result is consistent with Arlin's (1875) position that problem finding is a developed skill and only becomes distinct from problem solving skill during adolescence." (Runco & Okuda, 1988, 217) Can you see the educational progression from the very basics to higher-level creativity?
- High-level creative thought has already worked through basic solutions thousands of hours and repetitions ago. What is left are novel solutions born of a rich mental model.

The Surprising and Unique Usefulness of Teaching The Arts

- **There are no B+'s in arts education**, yet some celebrate them elsewhere. What is going on?
- It is interesting to note that if we got our dry cleaning back with 89% of the stains out, or our Happy Meal missing 11% of what we paid for we would find that unacceptable, yet we can consider that a successful level of competence in other areas. The goal of all learning is competent performance, and music shows us how to teach it. Somewhere around 98% accuracy or better in learning basic skill elements in any subject is competence, not excellence.
  - Why Music Education Matters in Academics: It May Not Be What You Think. (Goodhart, 2014)
- Imagine a 90-minute play or music performance in which 11% (10 full minutes) were unintended (mistakes). That is not 10 mistakes, but 10 full minutes of them. Imagine visual art with 11 percent that was not at all what the artist intended.
  - *Why A is Not Enough* https://youtu.be/KpyzGO2aQzE?t=20 (Devonshire, 2011, 2:30)
- Arts teachers must, as a normal part of their jobs to be considered 'good,' get all of their performing students to about 98% or better. The really good ones get very close to 100%. I taught music successfully for 13 years at the high school level. It is a common myth that arts teachers at the pre-college level seek out 'talented' students, or identify them in their classes, and then develop them. What we do is take anyone and everyone and know that if they will follow our directions (the learning process in its purest form) they will get good.
- **Teaching the arts teaches learning.**
  - The goal of all learning is performance
- Because of this arts teachers, as a natural course of doing their jobs over the last few centuries, have had to learn the essence of the learning process and immerse students within it, literally rewiring the brain physically and functionally. This process has been around as long as humanity, and is responsible for all great human achievement from the Renaissance (the apprenticeship model is excellent for developing mastery) to Beethoven's symphonies and Jimi Hendrix' guitar work.

- Newer research has begun to enlighten us as to what is going on neurobiologically in arts instruction that serves this.
- *Improved Effectiveness of Performance Monitoring in Amateur Instrumental Musicians.* (Jentzsch & Kansal, 2014)
    - ". . .for present purposes, higher levels of musical practice were also associated with a better engagement of cognitive control processes, as indicated by more efficient error and conflict detection. . .and reduced post-error interference and post-conflict processing adjustments." (p. 21)
        - To put it another way it trains the brain to search for areas of error, is able to maintain focus instead of giving in to frustration, and then make adjustments based on finding those errors over and over as one works. I believe we teachers have a word for that – learning. That is how learning works for any subject, any skill, anything. The more you do of it the better, smarter, faster you get.
- It turns out that high efficiency learning does not work the way most people think it does (is it any wonder we've been trying to 'fix' our school system for over half a century?)
- So then what is it, what is the difference? Process over content. How can we understand the essence of what we do to teach students to apply this everywhere, and even teach our academic colleagues how to get results more like ours!

Whether you think you can, or you think you can't – you're right.

-attributed to Henry Ford

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Some Suggested Reading

The first three are a great jumping off point for things you need to know and research. Starting anywhere you like will be beneficial as well.

Talent is Overrated: What *Really* Separates World-Class Performers from Everybody Else
Geoff Colvin

For my money the single best reference on the nuanced overarching idea of talent, how we wrongly perceive it, and how these implications inform teaching and learning. Unlike Outliers Colvin describes the things that you need to do to be successful. He also points to research you can review on your own. It is scholarly, but also it is an entertaining read.

Willpower: Rediscovering the Greatest Human Strength
Baumeister and Tierny

These researchers have done some amazing work on what happens in the brain with regard to self control and how it is been trained. They also cite other relevant research and weave together a compelling take on how discipline is learned. Another scholarly entertaining read. This, TIO, and Mindset are the fundamental must-reads of this list.

Mindset: The New Psychology of Success
Carol Dweck

Professor Dweck has spent over three decades researching the *psychology* of learning. Since learning is different than what most people think it is things like failure and mistakes seem to indicate a lack of ability to them. In an attempt to appear competent they cover this by not participating in learning. It is, of course, more complex than that and her work is fascinating. You will recognize it all around you and likely, as did I, in yourself to some extent.

Make It Stick: The Science of Successful Learning
Brown, Roediger III, and McDaniel

An owners manual for higher-level retention, retrieval and learning. Research based and also offering specific interventions, these powerful learning tools can be layered on to whatever successful teaching one is already doing. Be warned – these ideas are different and you must have a little patience for them to work. At first the illusory momentary improvement of massed practice will not be present, but after some time when asked to use our learning in context for things like tests and critical thinking the improvement over other methods will be obvious. In here you'll find the solution to things like testing anxiety. This is a bit technical even for some teachers, but the arguments for using high efficiency learning techniques that seem unusual are solid, and worth the read alone. The specific interventions in chapter 8 can be employed pretty readily.

The Little Book of Talent
Daniel Coyle

An owner's manual containing specific things great coaches and teachers use to maximize skill development. I am amazed that an investigative journalist could figure this out so well. I thought one would have to do thousands of hours of teaching. This is an invaluable resource.

The Talent Code: Greatness isn't born. It's grown. Here's how.
Daniel Coyle

Mr. Coyle elucidates an exciting theory at the time (2009), and proposes that all human improvement can be traced to a single biological process. This process is myelination. Myelin is an insulating sheath around axons in the brain. The more insulation the faster the nerve impulse travels, thus faster cognition, motor skills, etc.

Since 2009 important research has been published showing evidence that the underpinning process Mr. Coyle writes about is indeed accurate. As you read it keep in mind that starting in 2011 it has been shown scientifically that sending an impulse through an axon does cause an oligodendrocyte to produce myelin.

The Genius in All of Us: New Insights into Genetics, Talent and IQ
David Shenk

Another take on the same theme. He identifies a new paradigm for nature vs. nurture (nature *times* nurture) and explains how much of what we think about genetics is not correct. This is partly an introduction to epigenetics which is a very active field now.

The Power of Habit: Why We do What We do in Life and Business
Charles Duhigg

How hard is self control really? It can be developed into a habit. This is a well-researched, practical and interesting look into how our brains ingrain and act on habits and what we can do about them for ourselves and in teaching others.

Outliers: The Story of Success
Malcom Gladwell

Gladwell uses good storytelling to show how the environment we create influences success and that it is not innately limited. It is probably the most interesting read, but the least scientific, and he does not explain *how* the process works. I describe it as *Entertainment Tonight* to Colvin's *60 Minutes.* In any case it is a worthwhile read. The information on Canadian hockey players and how that speaks to the talent myth is worth the price alone

Good Business Leadership: Flow, and the Making of Meaning.
Mihaly Csikszentmihalyi

Csikszentmihalyi (pronounced 'Csikszentmihalyi') first described the concept of flow in the late 1990's. This is the state experienced when time melts away as you are working on a task. You've worked hard, done a lot, but it feels like hours have passed in moments. In Good Business, one of his several books on flow, he describes the concept on its own and relates to business structures. In any case the application of flow in any group setting has benefit and this book is quite illuminating. Don't dismiss it upon first read, it took a while for this to sink in, but when it did it had a profound effect.

The Willpower Instinct: How Self-Control Works, Why It Matters, and What You Can Do To Get More of It
Kelly McGonigal

A great companion to the Baumeister/Tierny book. Suggests exercises you can try for a week at a time and looks at some of the issues from a different angle.

Addendum:

The Cambridge Handbook of Expertise and Expert Performance
Edited by K. Anders Ericsson et a.

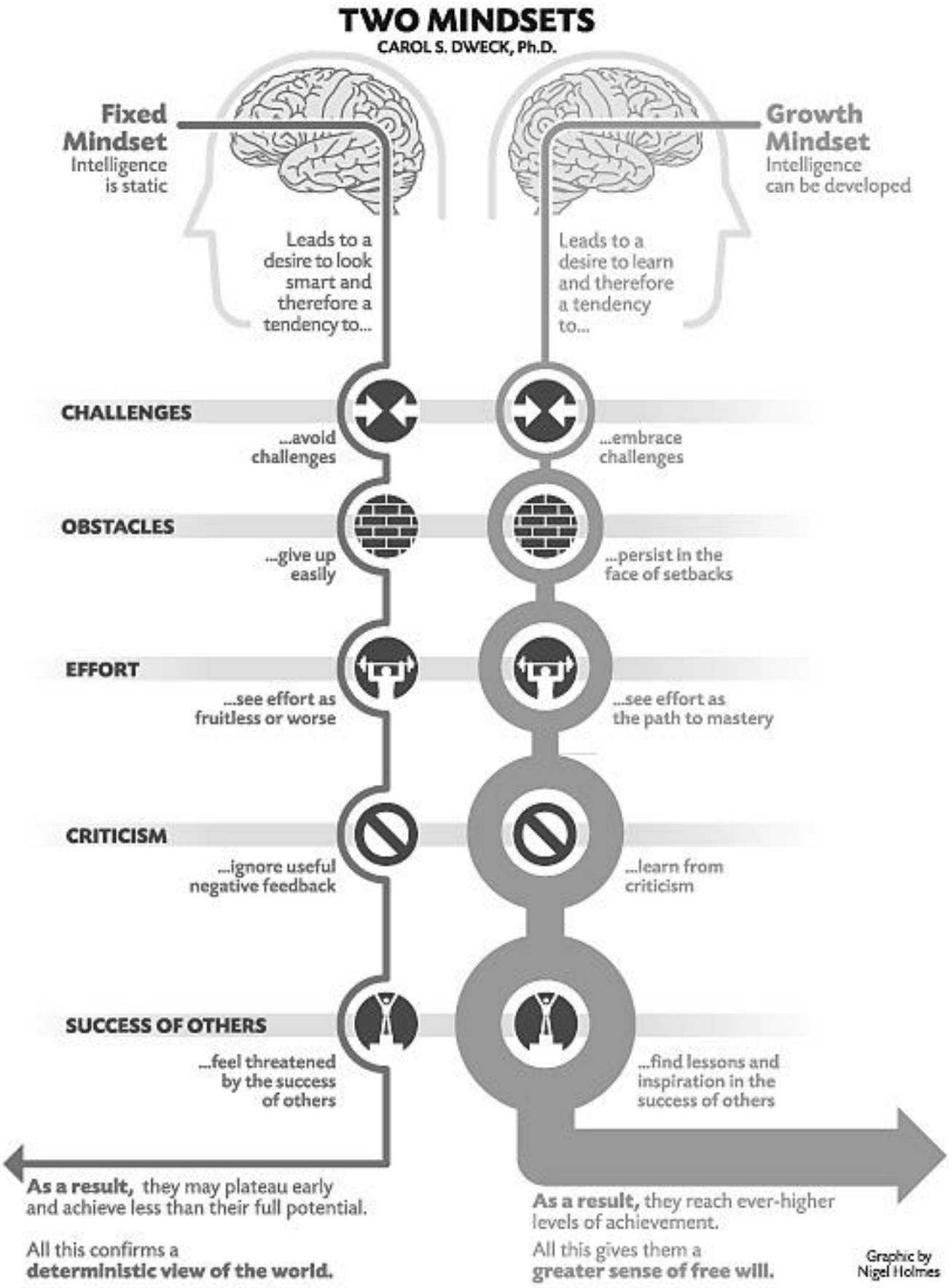
Ericsson has established himself and his team as the leading research authority on skill acquisition and expertise over the last 30 years. This is not a book per se but a collection of peer reviewed studies on all aspects of performance development including how it is done in specific fields, how motivation works, the specific process of skill acquisition (deliberate practice) and more. It is not a light read, very clinical, and at 900+ pages I myself have not read it all. I have read much of it and its organization makes it easy to pick which studies one wishes to read (I have found no need as of yet to read how one becomes an expert in software design, for instance).

The Role of Deliberate Practice in the Acquisition of Expert Performance. 1993
Anders Ericsson et al.

The seminal paper that first described the path to world class performance. It is available online. He updated it in the Cambridge Handbook as, "The Influence of Experience and Deliberate Practice on the Development of Superior Expert Performance," but what he wrote in 1993 is still accurate. If you like the 1993 paper then spend the $60 on the book.

The Strategy Specific Nature of Improvement: The Power Law Applies by Strategy in Task
Delaney et al.

Identifies the efficacy of varied repetition in learning.



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Weekly Time Inventory

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
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