

# TWO SECRETS IN LEARNING

Lee Chu Keong  
Nanyang Technological University

# THREE!


## ~~TWO~~ SECRETS IN LEARNING

Lee Chu Keong  
Nanyang Technological University

# The Three Secrets


- **The real meaning of an “A” grade**  
(arising from a narrow understanding of “intelligence”)
- **The curse of the “A” grade**  
(“strategic studying”)
- **Your belief matters**  
(be careful what you believe in)

# Gardner's Theory of Multiple Intelligences (1983)

- Linguistic
  - Logical-Mathematical
  - Visual-Spatial
  - Bodily-kinesthetic
  - Musical
  - Interpersonal
  - Intrapersonal
  - Naturalist
- 

*Society differentially esteems these intelligences!*

# Sternberg's Triarchic Theory of Intelligence (1985)

- Intelligence has **three fundamental components**
  - analytical, creative, and practical
- **Analytical Intelligence**  **focus**  
critical thinking and problem-solving – this is what intelligence tests typically measure and what our current education system [**over-**]  
**]**emphasises and [**over-**]**]**rewards

# What's Neglected

- **Creative Intelligence**

the capacity to generate new ideas and new ways to solve problems

- **Practical Intelligence**

one's ability to understand what is needed in a given situation and respond effectively to the circumstances

# The Problem With Focusing Too Narrowly

**We need ALL THREE!**

We need **creative intelligence** to come up with an idea, **analytical intelligence** to know if it's a good idea, and **practical intelligence** to sell it.

Sternberg

# A More Serious Problem With Focusing Too Narrowly ...



To understand this, let's examine  
the work of Neisser



# Neisser (1976)

- Highlighted the distinction between:
  - ▣ academic intelligence
  - ▣ the kind of intelligence needed to carry out the practical tasks found in the everyday world and to solve the practical problems found in daily living
- Contrasted classroom problems with real problems

# Classroom Problems

- Well-defined
- Formulated by others
- Come with all the information required for problem solution
- Have one correct answer
- Have one or at most several methods of obtaining the correct answer
- Be unrelated to everyday experience

# An Example of a Classroom Problem

Solve:

$$\int \sqrt{\tan x} \, dx$$

# Real Problems – Characteristics

- Ill-defined
- Formulated by the problem solver
- Missing information essential to solution
- Have multiple solutions, each associated with its own set of pros and cons
- Have multiple methods of obtaining the solution
- Related to everyday experience

# An Example of a Real Problem

Singapore's birth rate has been steadily declining for some twenty years. There are many serious consequences.

One consequence: In 2011, 7.0 working adults supported one retiree. By 2030, 2.3 working adults will have to support one retiree.

How can the government encourage marriage and parenthood?

# Classroom Problems – Characteristics

$$\int \sqrt{\tan x} dx$$

- solvability assured
- solvability within some time limit assured
- question within syllabus
- “something our students can do”
- will not result in too many “casualties”

# Real Problem

Singapore is ageing rapidly. How could the government encourage marriage and parenthood?

- solvability not assured
- much less, solvability within some time limit
- no syllabus
- “something our students can do” – meaningless
- will not result in too many “casualties” – meaningless

# Secret No. 1: The Real Meaning of an “A” Grade

An indication of one’s ability to solve problems that have already been solved many times over.

No indication of one’s ability to solve **real** problems.



# Disconcerting, But True

---

At the end of a person's educational life, his ability to solve **wicked** or **real** problems remains largely untested.

# Making Things Happen



Some people want it to happen, some wish it would happen, others *make it happen*.

Michael Jordan

# Missing Shots

---

I've **missed** more than **9,000** shots in my career. I've **lost** almost **300** games. Twenty-six times, I've been trusted to take the game winning shot and **missed**. I've **failed over and over and over again** in my life. And that is why I succeed.

Michael Jordan

# The Concept in Question

---

- **Expert** performance
- **Extraordinary** performance
- **Exceptional** performance
- **Outstanding** performance
- **Superior** performance
- **Eminent** performance

# Examples

- In physics, Albert Einstein
- In football, Diego Maradona
- In swimming, Michael Phelps
- In piano performance, Lang Lang
- In pop music, Michael Jackson
- In business, Bill Gates
- In investment, Warren Buffet
- In hacking, Kevin Mitnick

# A bit of history ...

---

Galton observed something about eminent individuals in the British Isle – they were more likely to have close relatives who were also eminent than to have distant relatives who were eminent

His conclusion: eminence (exceptional performance in a field) must be transmitted from parents to their offspring

# Galton

---

Galton studied people who perform “acts that lead to reputation”:

If a man is gifted with vast intellectual ability (capacity), eagerness to work (zeal), and power of working (industriousness), I cannot comprehend how such a man should be repressed.

# Galton

Eminence was a virtually inevitable consequence of inherited “natural ability,” which was the conjunction of **three types of elements**:


- [1] natural ability (vast intellectual ability)
- [2] zeal (eagerness to work)
- [3] industriousness (willingness to do a great deal of laborious work)



# The Big Question

---

Are experts *born*,  
or are they *made*?



To understand this, let's examine  
the work of Ericsson, Krampe  
and Tesch-Romer

# The Accuracy of Old Phrases

The phrase “practice makes perfect” is not necessarily true. What is true:

“practice makes **permanent**”

The *type of practice* carried out determines the difference between **expert skill development** and the **maintenance of mediocrity**.

# Practice and the Brain

- Any practice changes the brain physically because learning cannot occur without the growth of neuronal dendrites
- Dendritic growth makes practice permanent – thus, practice can produce mediocrity as efficiently as it can produce excellence

# Deliberate Practice (DP)



Ericsson, Krampe and Tesch-Romer calls the type of practice that develops expert skill “deliberate practice”.

# Deliberate Practice (DP)

- Refers to the technique that eminent athletes, musicians, chess players, etc., use to achieve exceptional performance
- It is practice that is *consciously intended* to improve one's skills
- It involves goal-directed activities, which tend to be *repetitive* and to enable rapid feedback

# What Superior Performance Does NOT Require

The DP framework *rejects*

- **innate talent** as an explanation for superior performance.
- the “**you’ve got it or you don’t**” belief

Concludes that superior performance doesn’t *necessarily* require a particular inborn talent.


# Superior Performance Requires

motivation and maturity

– mainly because it isn't easy

- DP is typically performed individually, tends to be carried out with great effort and **\*not\*** **enjoyable**



- 
- DP can be carried out just for a few hours a day (but not such a long time that they become inefficient or even hurtful)

# Characteristics of DP (1)

- A focused effort consisting of training activities designed for the purpose of improving performance.
- Most effective when accompanied by a teacher's guidance.
- The goal is self-directed learning, and so, a teacher is most important early and progressively less important.

# Characteristics of DP (2)

- Lots of repetition, with sharp focus
- Not everyone uses DP because it isn't fun
- Also, not everyone chooses to become an expert
- Not work or play, just focused effort
- Studies show that expert skill levels are only achieved after about 10,000–50,000 hours of DP

# Characteristics of DP (3)

- Requires continuously available feedback.
- In knowledge management terms, it is best achieved through socialisation, where the one-to-few teaching situations provide many opportunities for feedback
- In academia, the supervision of doctoral students is a good example – the supervisor supervises only a few students at any one time

# Characteristics of DP (4)

- Is tiring, and so, hard to sustain
- Continuously looks ahead to the “next level”
- Does not repetition of already mastered tasks, but the tasks “at the next level”

# Characteristics of DP (5)

- Changes the brain physically
- Steady progress toward expert performance occurs because the brain is always ready to grow more dendrites
- The path to expert performance involves growing the *right dendrites*

# Characteristics of DP (6)

- It isn't fun, and probably very boring
- DP is done not because it is fun
- It is done because it is the only path to superior performance

# Domain-Related Activities

---

- DP should be contrasted with other activities, work, play, and deliberate practice
- The goals, costs, rewards and the frequency with which individuals pursue them differ



# Work

- Work includes services rendered for pay and other activities directly motivated by external rewards
- Work is constrained in time it requires individuals to give their best performance at a given time
- Work is performed for a living

# Work (con't)

- The costs of mistakes or failures to meet deadlines are generally great, which discourages learning and acquisition of new and possibly better methods during the time of work
- After a period of internship, individuals are expected to acquire an acceptable level of performance, after which opportunities to explore alternative methods are limited

# Work (con't)

- Highly experienced users of computer software applications are found to use a small set of commands, thus avoiding the learning of a larger set of more efficient commands
- Limitations at work: Although work activities offer some opportunities for learning, they are far from optimal

# Play

- Play includes activities that have no explicit goal and that are inherently enjoyable.
- Individuals are completely immersed in an activity, and this is completely opposed to what is required to achieve mastery
- In both play and deliberate practice, external rewards are almost completely lacking

# Deliberate Practice

- DP includes activities that have been specially designed to improve the current level of performance
- Critical aspects of the situation and incrementally improve her or his performance in response to knowledge of results, feedback, or both
- The goal is to improve performance, not to earn a living

# Deliberate Practice (con't)

- Specific tasks are invented to overcome weaknesses, and performance is carefully monitored to provide cues for ways to improve it further
- Individuals are motivated to practice because practice improves performance, not because it is enjoyable

## To Sum Up ...

---

The path to eminent performance is a matter of choice

However, there is a *cost* to eminent performance, and the cost is very high

Are you willing to foot the bill?

Secret No. 2:

The Curse of the “A” Grade

75%



# Case 1: Peter

- General Paper - A (76)
- Mathematics - A (77)
- Physics - A (77)
- Chemistry - A (76)
- Literature - A (76)

**Strategy-driven approach**

# Case 2: John

- General Paper - C (60)
- Mathematics - A (99)
- Physics - A (100)
- Chemistry - C (62)
- Literature - D (55)

Passion-driven approach

# Let's Put The Two Secrets Together



# Three International Benchmarks

---

- Trends in International Math and Science Study, TIMSS
- Progress in International Reading Literacy Study, PIRLS
- Programme for International Student Assessment, PISA

# Singapore's TIMSS Results

1995	1999	2003	2007	2011
1 <sup>st</sup>	—	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>
1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>	3 <sup>rd</sup>	2 <sup>nd</sup>

1995	1999	2003	2007	2011
10 <sup>th</sup>	—	1 <sup>st</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>

# Singapore's PIRLS (2011) Results

## Fourth position

Hong Kong SAR	– 571
Russian Federation	– 568
Finland	– 568
Singapore	– 567

# Singapore's PISA (2012) Results

- Scored highest in the PISA 2012 assessment of problem solving, with 562 points on the PISA proficiency scale
- Had the highest number of top-performing students in problem solving: 29% of students reach proficiency Level 5 or 6 (the OECD average is 11%)

# Subject Olympiads (2014)

- International Mathematical Olympiad – 8<sup>th</sup>
- International Physics Olympiad – 9<sup>th</sup>
- International Chemistry Olympiad – 1<sup>st</sup>
- International Biology Olympiad – 2<sup>nd</sup>





What about **truly eminent**  
**achievements** (peaks or excellence)?

# Extraordinary Performance?

---

Nobel Prize – 0

Field's Medal – 0

Wolf Prize – 0

Turing Award – 0

Pulitzer Prize – 0

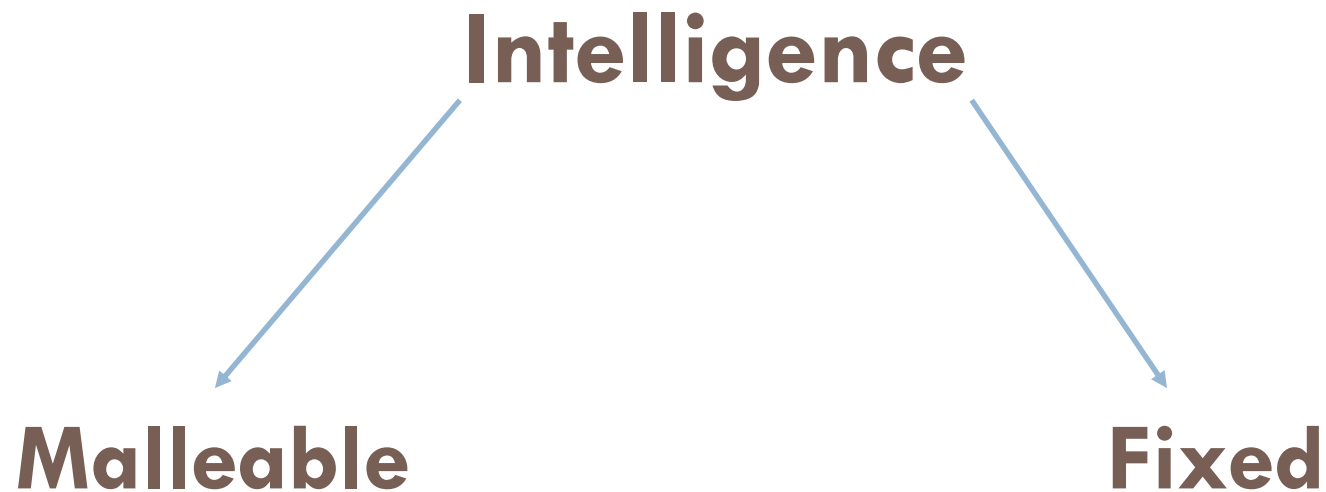
Kavli Science Journalism Awards – 0

Walter Sullivan Award – 0

Winton Prize – 0

# Why?

# Beliefs That Make Smart People Dumb – Carol Dweck



# Central Issue

- Why people who have all the ability one could wish for often don't use it when they need it most, and can even lose it (relative to their initially less able peers)
- Reason: Many smart people become *too invested* in being smart
- They become *too focused* on being smart and looking smart (traits of intelligence) rather than one challenging themselves, stretching and expanding their skills, becoming smarter (process of learning)

# Belief #1: I have “Static” Intelligence

- Intelligence is a fixed trait
- Each person has a certain finite amount
- Some are lucky, they are smart, some are not so lucky
- Most people with this view hope they rank among the intelligent
- What they don't know is at what level their intelligence is at
- They start looking out for *performance outcomes* and avoid learning opportunities that might expose their inadequacies (make them look bad/stupid)

# Belief #2: I have “Dynamic” Intelligence

- Intelligence is a potential that can be developed or cultivated over time
- Everyone can become smarter by developing their intellectual potential – e.g., by working hard, taking on challenges, striving to learn
- These activities will allow them to grow intellectually
- Personal striving, education, and intellectual stimulus is important

# Important

- Dweck's research focus is *not* on which belief is correct
- I.e., she does *not* set out to prove Belief #1 is correct, Belief #2 is wrong or vice versa
- She investigates the effects of people's belief on their behaviour
- NOTE: Most people (85%) tend to hold one belief or the other

What's ***your*** belief about intelligence?

# Students at Ivy League U

- Provided *scenarios* of intellectual failures, and asked to imagine that it happened to them
- They were then asked: (1) how they felt; (2) what they thought; (3) what they would do
- Essentially, Dweck wanted to know what failure meant to them, and what it would do to them
- FI: failure = they were dumb, worthless, a loser – devastated, give up hope of success in that area
- MI: failure = indication of their *current* skill, they needed to do something differently to succeed



# Students at Top U

- Fl: Academic performance = worth as a person
- E.g., “To be honest, if I didn’t do as well in school as I hoped, I’d think less of myself as a person.”
- Fl: poor performance indicative of a lack of intelligence – a lack of intelligence indicative of a person of low worth
- Fl: doing well indicative of intelligence – intelligence indicative of a special and worthy person

# U in Hong Kong

- Students were “primed” ( $1/2-1/2$ ) to by giving them articles on fixed and malleable intelligence
- Students were then given a task that was challenging
- Student that had read the article on malleable intelligence viewed their difficulty with the task as reflecting on their effort and were more persistent in their pursuit of mastery
- Important conclusion: A person’s belief about intelligence can be changed!

- At Stanford U, it was found that teaching students about malleable intelligence raised their GPA and their commitment to school
- Students who focus on malleable intelligence:
  - ▣ feel better about themselves
  - ▣ do better when they are confronted with challenging work
- Students who focus on fixed intelligence:
  - ▣ poor performance
  - ▣ loss of academic standing

# Big Questions

---

- How does this happen (the cause-and-effect)?
- What is the link?



# Sacrificing the Chance to Learn

- FI: miss out on learning opportunities
- Fear: it reveals their ignorance (learning *is* about learning something one doesn't already know)
- Fear: it increases the odds of them making an error
- Both calls into question their intelligence and worth
- Students were asked: When do you feel smart?
  - FI: When doing something I'm good at (and so, will prefer a “safe” task)
  - MI: When striving to learn or understand something new (and so will be take on tasks that FI considers “unsafe”)

# Research in “a HK U”

- In a HK U, students that were deficient in their English proficiency were given an opportunity to take an English course
- Students who held FI view did not sign up!
- What it shows: Students who held FI were not willing to take steps to remedy their deficiency – students who held MI were willing! **Imp**t finding!
- In organisations: (1) Hiring implications?; (2) KM implications?; (3) Training implications?

- Students who hold FI care so much about looking smart that they act dumb (they say “pass” to opportunities that would allow them to learn what they were poor at)
- They do not avail themselves to learning opportunities
- This is one way smart people can become relatively less smart over time (*What about managers who feel they have to look smart? What would it do to them?*)



# Denying the Power of Effort

- FI: If you're truly intelligent, you don't need effort
- If you're really smart at something, you shouldn't have to work hard at it
- Things come easily to people who are true geniuses
- MI: Even geniuses have to work hard
- What is true: If two people do the same task and one requires less effort to do it, that person is probably more skilled at that task at that time (p. 31)



- However, most tasks in life at some point require a great deal of effort no matter how smart you are!
- The problem with the beliefs of FI is this:
- Those who believe smart people shouldn't have to work hard may not put in the work required to accomplish what they're really capable of
- I.e., this belief leads to self-defeating behaviour
- When confronted with a challenge FI would start to worry about their intelligence, their adequacy to perform the task

- This may lead them to do something defensive (to save face) – to slacken, to pretend not to care
- This dooms their performance
- This is called self-handicapping – the tendency to do things that will prevent you from looking like you have low ability
- Priority: to *look* smart; to avoid looking stupid
- Where it should be: To work hard learn (“who cares if everyone is looking?”) to something new

# In Singlish ...



People who believe in FI sabo themselves directly by withholding effort – motivation is curtailed



# Missing Out on the Pleasure of Effort

- Working towards valued goals in life – a source of gratification – it gives life much of its meaning
- If work and effort undermines intelligence and worth, then they are bound to become aversive!



# Never Knowing What You Could Have Been

- Robs people of the opportunity of fulfilling their full potential
- Thought pattern: It's the smart ones who make the contributions; I'm not smart (e.g., I didn't score 8/9/10 As, I needed to work 3 weeks to understand completing the square; I didn't get into the gifted programme), so I'm not going to make contributions
- When experts have found that: Motivation is the key to creative contribution and creative genius! It's how many hours you put in, not how much "innate talent" you began with!

# Secret No. 3: Your Belief Matters



**... in determining what you learn,  
and whether you continue to learn.**

# The Point of the Presentation

---

Seek mastery, ...  
not just paper.

Strive for greatness, ...  
eschew mediocrity.

Watch your belief.



# Thank you.

Lee Chu Keong

[ascklee@ntu.edu.sg](mailto:ascklee@ntu.edu.sg)

[ascklee.org](http://ascklee.org) | [slate.adobe.com/a/WoNNQ](https://slate.adobe.com/a/WoNNQ)