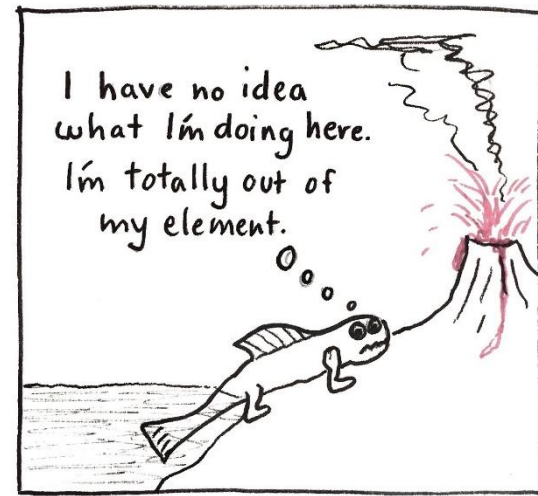


Research Skills for a Stronger South Africa

DAVID L. TABB, PH.D.

STELLENBOSCH UNIVERSITY



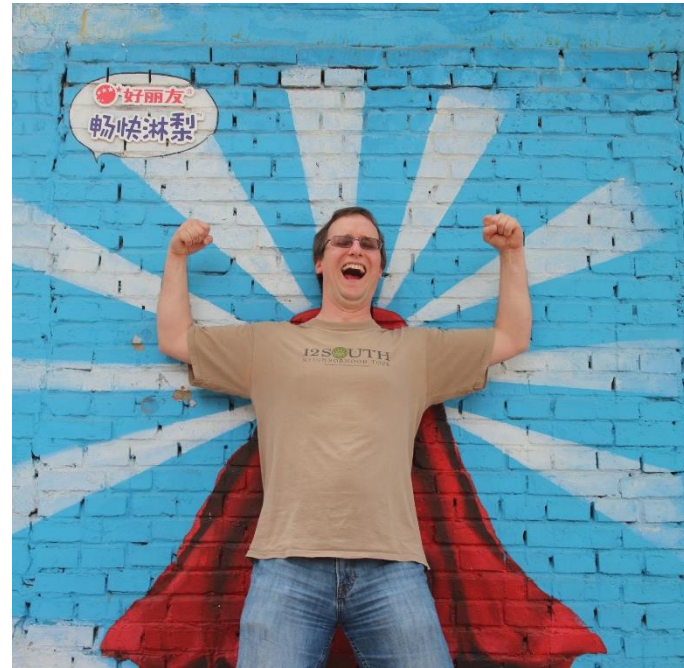
The Birth of Imposter Syndrome
@redpenblackpen

Overview

- Critical thinking: inputs, processing, and outputs
- Research skills in industrial settings
- Research skills as a civic necessity

Who is this Dave Tabb guy, anyway?

- Middle-aged, born 1973
- American, from Missouri
- Relocated, here since 2015
- Experienced, with 100 papers
- Well-known (in proteomics)
- Noisy, via YouTube and Twitter



Surely there is a better messenger!

- Industrial experience limited to a semester-long co-op in 1995
- Government experience limited to post-doc in 2003-2005.
- South Africa does not need an American telling it what to do.

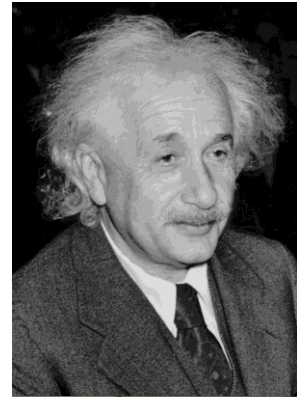


“I’m not learning anything
useful in grad school.”



Research training \neq pub trivia.

- “The value of a liberal arts college education is that it trains the mind *to think*.”
 - Albert Einstein 1879-1955
- “It is better to know *how to learn* than to know.”
 - Dr. Seuss 1904-1991



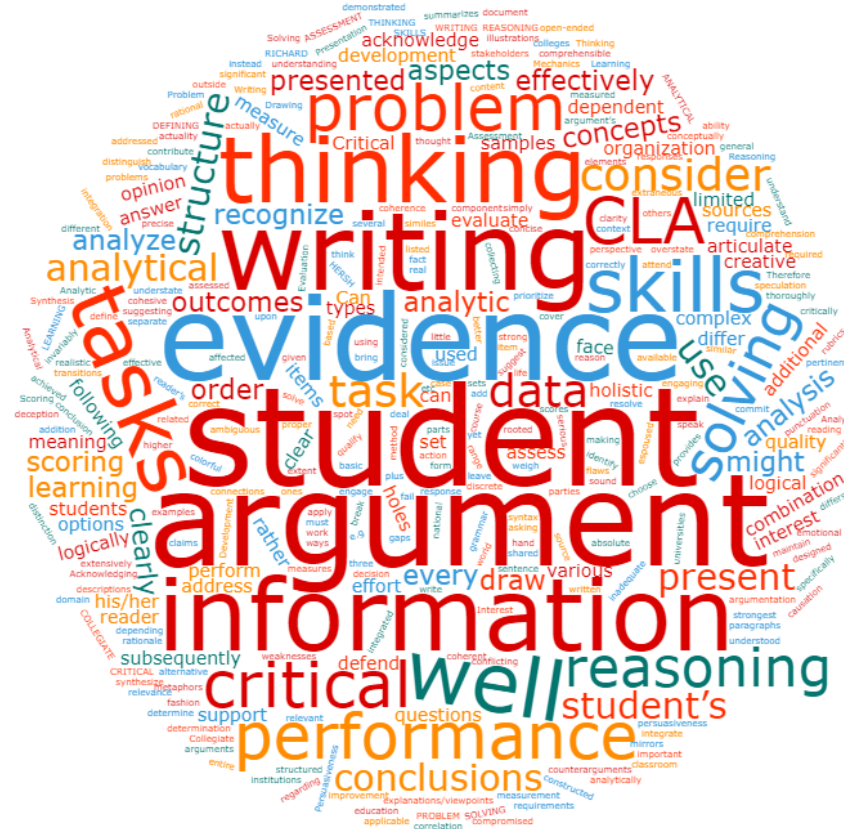
“Go into the wilderness; come back with *fire*!”

- Start with an ambiguous claim and a vague idea of how to proceed.
- Discover the pitfalls and hidden logic errors in the initial plan.
- *Fail forward*, improving the quality of the claim and the method to test it.
- Report knowledge that we lacked when you started your task!





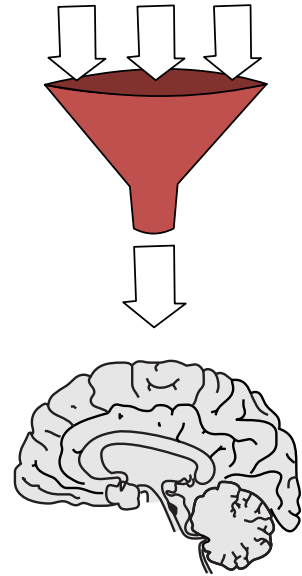
What is critical thinking?



**“Collegiate Learning Assessment:
Defining Critical Thinking,
Analytical Reasoning,
Problem Solving and Writing Skills”
Richard H. Hersh @ Skidmore.edu**

Research teaches you to fill your brain effectively

- Retrieve: know where to go for needed details
- Focus: understand which parts matter
- Decipher: parse numbers into meaning
- Interpret: comprehend graphical representations
- Infer: recognize what has been left out
- Assimilate: contextualize new data with known facts



Research teaches you to consider data effectively

- Collate: integrate parts to produce a whole
- Contrast: detect differences
- Reflect: determine whether data match expectations
- Extrapolate: imagine the response to new inputs
- Synthesize: form a *gestalt* at high level
- Plan: decide upon a course of action



Research teaches you to report findings effectively

- Design: select the first strokes on *tabula rasa*
- Verbalize: represent concepts with the right words
- Visualize: convey data intuitively
- Cite: annotate contributions from published work
- Commit: completing the project and standing behind it
- Propose: make the case for your next steps



Research thinking matters in business

- “Using a structured thinking process will actually save employees time in the long run because they avoid making mistakes such as jumping to the wrong conclusion or making a decision that others reject down the road.”

■ Jen Lawrence

Engage the Fox: a Business Fable

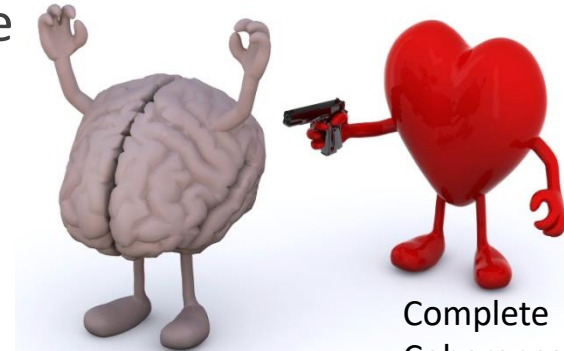


EURObiz

Research alters your decision-making

- “We’re emotional creatures by default. We’re trained to think with emotions instead of using statistics, logic, reason, etc. Society fosters emotion-based thinking and decision making.”
- Critical thinkers are open-minded, confident, decisive, not reliant on others’ approval and able to see past their emotions when making choices
 - Steve Siebold

*177 Mental Toughness Secrets
of the World Class*



Research teaches self-skepticism

- “How could the results be wrong?”
- Are the results consistent with established theory?
- Are the results consistent with the available data?
- Have the best possible methods been used?
- What are the potential sources of error?
- Do assumptions affect the results?
- Are the results statistically significant?
- Is the preferred hypothesis the only and most plausible explanation?”



Tonytoucan, deviantart

Your numerical talents are both rare and necessary

- ‘Labour markets, meanwhile, are becoming biased towards a limited range of technical skill sets, and globally connected digital platforms and marketplaces are granting outsized rewards to a small number of “stars”.’

--Klaus Schwab, *The Fourth Industrial Revolution*



- “I have to lay off hundreds of people because their jobs have disappeared and I do not need their skills – and I have hundreds of job openings I can’t fill because I can't find people with the right training and skills.”

--L. Rafael Reif. President, MIT

Top 10 in-demand skills in South Africa

1. Statistical Analysis and Data Mining
2. Java Development
3. Network and Information Security
4. Mobile Development
5. Perl / Python / Ruby
6. User Interface Design
7. Middleware and Integration Software
8. Web Architecture and development Framework
9. Mac, Linux and Unix Systems
10. Public Policy and International Relations

What if you never do research again?

- Are you obligated to be a researcher just because you finish an M.Sc. or Ph.D.? *NO!*
- Graduate training opens the door to management posts, to advisory boards, and even to elective office.



Might our next president have an M.Sc. or Ph.D.?



Critical Thinking is central to citizenship

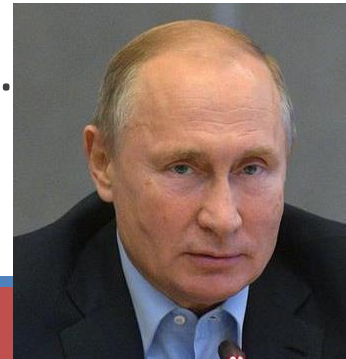
“Many good-hearted people cannot see through and critique propaganda and mass manipulation, and most good-hearted people fall prey at times to the powerful tendency to engage in self-deception, especially when their own egocentric interests and desires are at stake. One can be good-hearted and intellectually egocentric at the same time.”

We prepare to resist “Fake News.”

- Many groups want to “spin” the public or manipulate their emotions to deceive them:
 - The Russian government interfered in American elections.
 - Manufacturers of “miracle cures” try to sell products.
 - Dubious journalists try to “click bait” you into interest.
- A trained researcher learns skills to resist these ploys.

**LOST LOVE
SPECIALIST
SAME DAY RESULTS**

“You won’t believe #7!”



“Now we are equipped to be dangerous!”

- Self-educating: able to find our own gaps and improve them
- Flexible: able to manage ambiguity and error
- Pioneering: ready for independent operation and leadership

