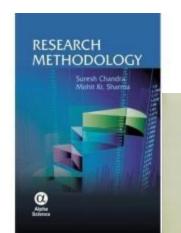
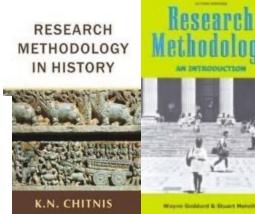
CSCIT940 CS Research Methodology Spring Session 2024

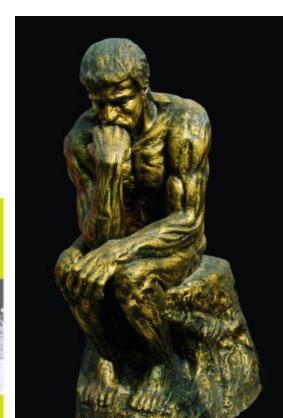












This set of slides is still being edited.

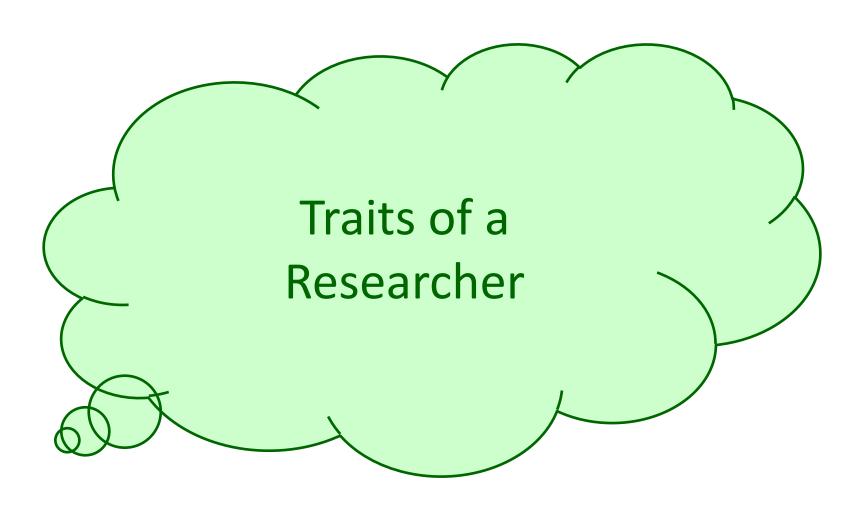
Will replace with an updated copy soon



This set of slides was edited from previous slides used for this subject. --LeongHW

Highlights of Lecture

- Traits of a Researcher
- How to be a Successful Researcher
- Research Measurement : What is Good?
- Critical Thinking vs Creative Thinking
- Optional: A Talk on Creatology (by nobel)



Research is the locomotive of innovation

Characteristics of Good Researchers

- 1. Personal Ideal
- 2. Attitude
- 3. Vision
- 4. Aims and Plan
- 5. Time Usage
- 6. Learn and Change
- 7. Integrity

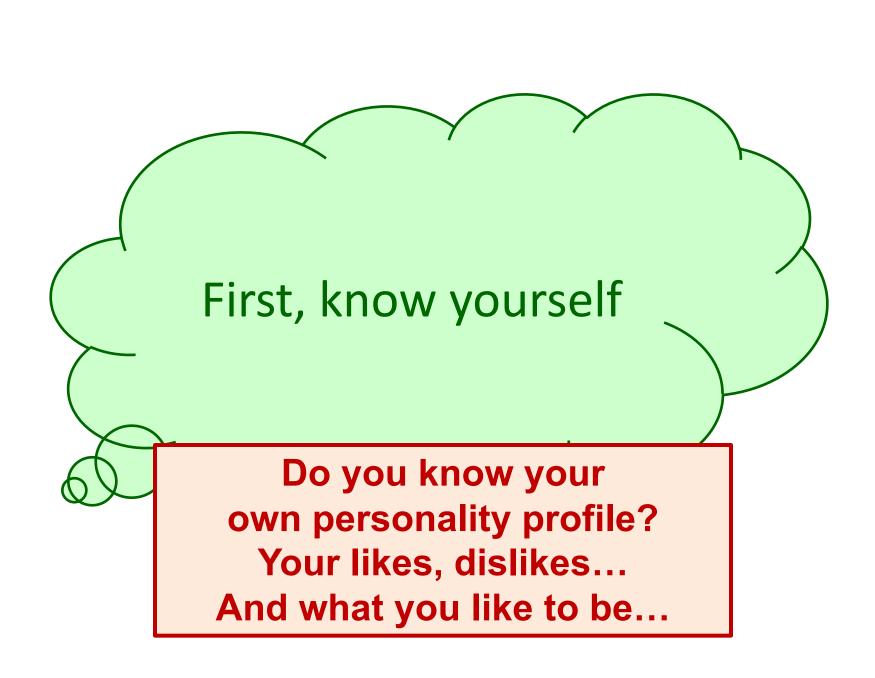
Characteristics of Good Researchers

An example:

Academic Integrity at MIT.

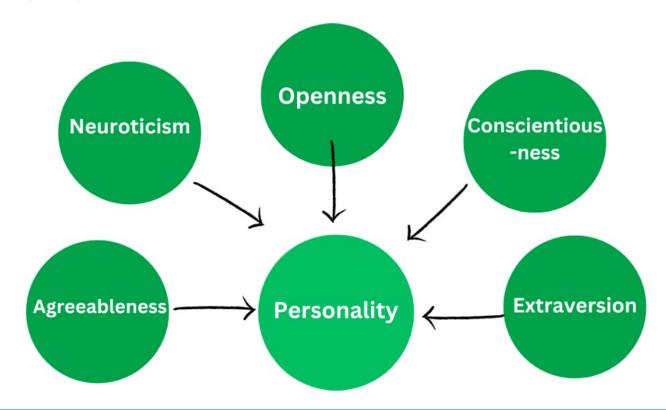
At MIT, pushing the boundaries of knowledge and possibility is our joyful obsession, and we celebrate fundamental discoveries and practical applications alike.

As educators, we also value research as a potent form of learning by doing.



Big Five Personality Traits (1/5)

 The Big Five personality traits, also known as the five factor model (FFM), is a model based on common language descriptors of personality.



https://www.16personalities.com/

Big Five Personality Traits (2/5)

Openness to experience:

(inventive/curious vs. consistent/cautious). Has Appreciation for art, emotion, adventure, unusual ideas, curiosity, and variety of experience.

Conscientiousness:

(efficient/organized vs. easy-going/careless). tends to be organized and dependable, show self-discipline, act dutifully, aim for achievement, prefers planned rather than spontaneous behavior.

Big Five Personality Traits (3/5)

Extraversion:

(outgoing/energetic vs. solitary/reserved). Energetic, positive emotions, urgency, assertiveness, sociability and the tendency to seek stimulation in the company of others, and talkativeness.

Agreeableness:

(friendly/compassionate).

Tends to be compassionate and cooperative rather than suspicious and antagonistic towards others

Big Five Personality Traits (4/5)

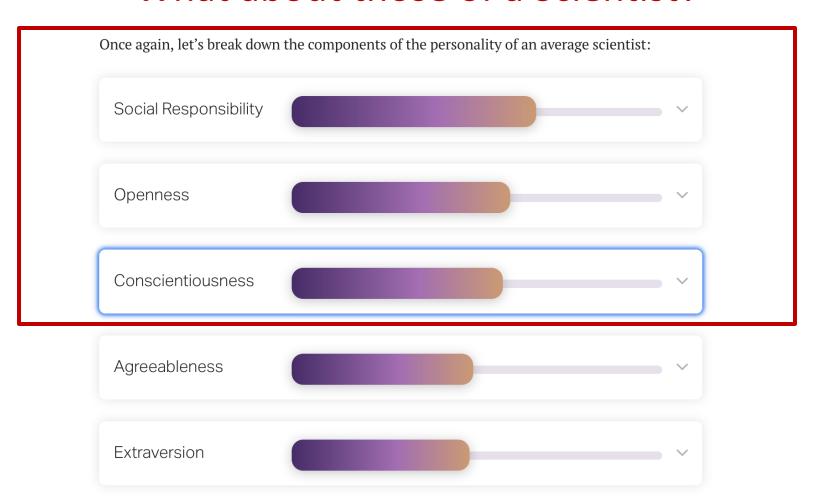
Neuroticism:

(sensitive/nervous vs. secure/confident).

The tendency to experience unpleasant emotions easily, such as anger, anxiety, depression, and vulnerability.

Traits of Scientist...

What about those of a Scientist?



Traits of a Scientist

High in:
Social Responsibility
Openness
Conscientiousness

What about YOU?

How near/far are you from "there"?

Reasons leading to Failure

- 1. Fear to succeed
- 2. Laziness (physics & mental)
- 3. Ignorance



Research is not done alone

- Success in research depends on balance of
 - Personal Characteristics
 preparation, characteristics, focus, effort
 - Inter-Personal Characteristics
 Assistance and support from others
 - Environmental
 Characteristics of local environment

Personal Characteristics (1/3)

- Know and enjoy what they are getting into!
 - Learn to like/love your research work
 - Enjoy academic freedom and research
 - Socialize in career and activities
- Have a focused area of research (at least initially)
 - Do well in this area
 - Know literature of this field (the WWWW-H)
 - Maintain an active and cooperative research group
 - Contribute to professional activities in this area

Personal Characteristics (2/3)

- Good, Consistent Work Habits
 - Strive for high productivity, especially in early career
 - Example: (Note: this varies from place to place)
 - Papers at least 2 per year
 - Grants At least 1 National/Federal or foundation in last 2 years
 - Reading keeping up with the literature!
 - Grow your research group

Personal Characteristics (3/3)

- Work on Simultaneous Projects at different stages!
 - Research work
 - Planning, Under review for funding Data collection, Data analysis
 - Manuscripts
 - In preparation, Under review,
 Revising, Awaiting publication, Published
- Contribute to professional activities
 - External- collaboration and conferences
 - Internally admin (department or institution), curriculum,

Inter-Personal Characteristics

- Have mentors (different types)
 - May be Collaborators, or Research-related Network
 - Help with Understanding the academic culture
 - Provide Emotional support
- Communicate with Others and Build "Network"
 - Learn to develop collegial NETWORKs!
 - Get Involved in and out of university
 - Go to conferences and become known! (well-known?)
 - Provides access "hot" fields, etc
 - Provides brain power -- Bounce "ideas off" other people

Your Environment

Sufficient Work Time

Must limit committees and prep time for teaching

Supportive Environment

- Autonomy (academic freedom)
- Senior Faculty/Dept Chairs who help with...
 - Grants, Publications
 - Professional contacts, Advice, Finding local mentors

Peer Support

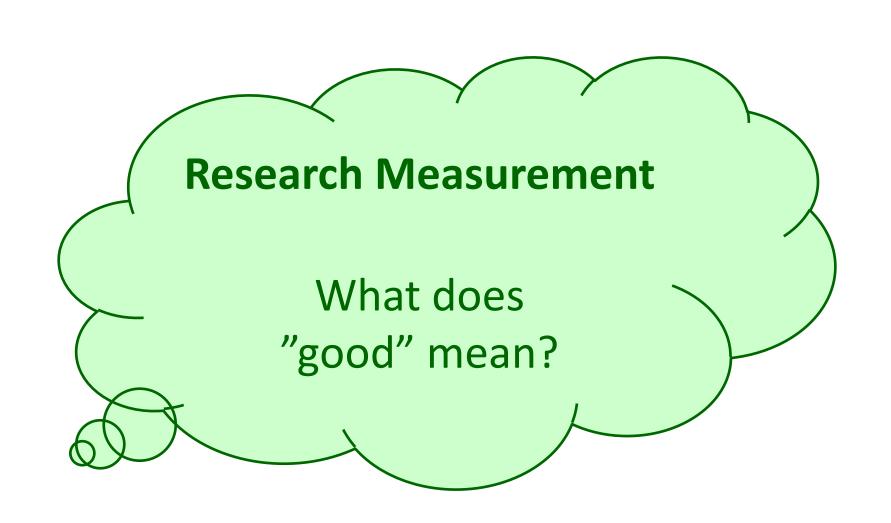
- Individual or Groups
- Support Your Research Group / Team
 - Recognize what the individual researcher needs
 - Recognizes strengths of individual researcher

Ask yourself

Do I like a career as a scientific researcher?

Can I grow to like that career?

How near/far am I from it?



Are these papers "good"?

- How to know whether a paper is good or not?
- Check the outlet (where paper was published)
- Check the "level" of the journal / conference
 - Web of Science
 - Journal Citation index
- "Reputation" among top researchers in the field

Journal Impact Factor

- impact factor (IF) of a journal is a measure that reflects the average number of citations to recent articles published in that journal.
- Idea of IF proposed by Eugene Garfield, the founder of the Institute for Scientific Info.

 The impact factors have been calculated annually from 1975. The results are indexed in the Journal Citation Reports.

Journal Impact Factor (example)

- IF is measured over a 2-year window.
- Example: IEEE Transactions on Software Engineering has an impact factor of 2.59 in 2012.
- This means that the papers published in IEEE-TSE in 2010 and 2011 (a 2-year window) received 2.59 citations each on average in 2012.
- Note: There is also the notion of a 5-year IF that uses a longer 5-year window.

H Index (aka Hirsch Index)

- The h-index is an index that is used to measure both impact and productivity of a scientist's published work.
- The index is measured based on the set of most cited papers and the number of citations on those papers.

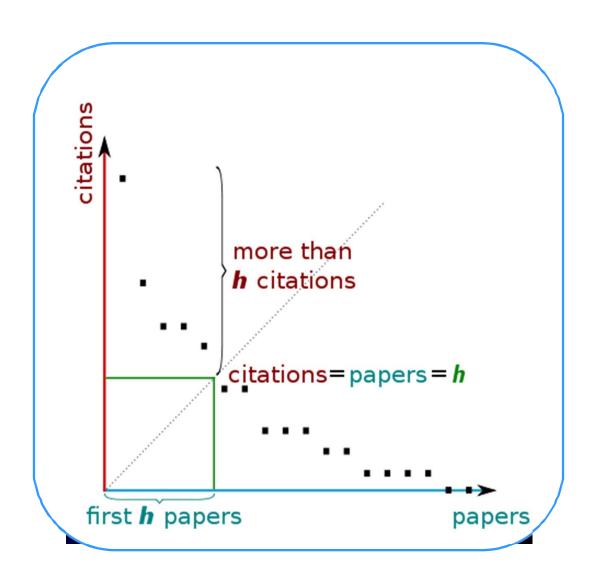
Proposed by Jorge E. Hirsch

H-index

 A scholar has an index h if h of N papers have at least h citations each, and the rest of the (N-h) papers have no more than h citations each.

That means, a scholar with an index of h
has published h papers, where each of
those papers has been cited by at least h
times.

H-index



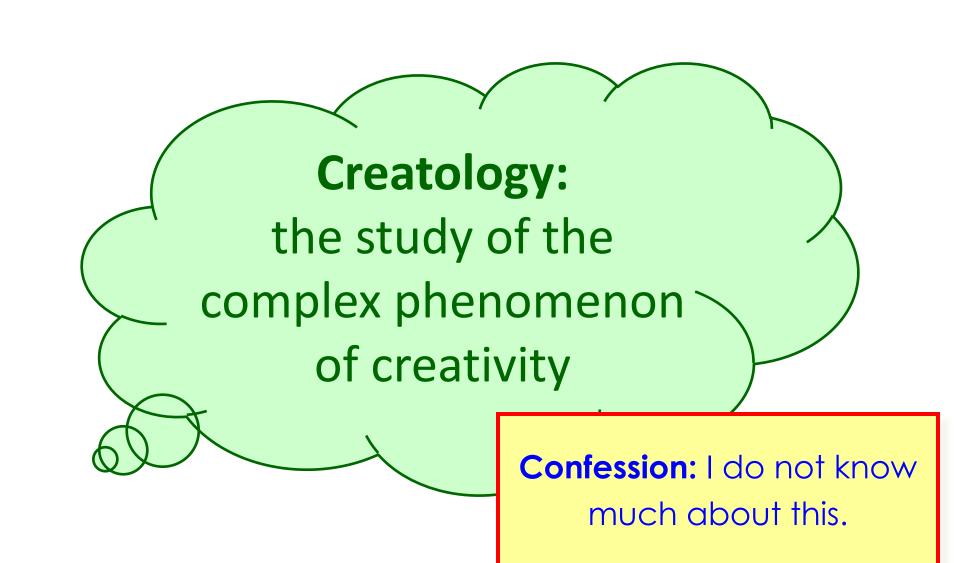
G-index

- g-index is used for quantifying scientific productivity based on publication record, which was suggested in 2006 by Leo Egghe.
- "Given a set of articles ranked in decreasing order of the number of citations that they received, the g-index is the (unique) largest number such that the top g articles received (together) at least g² citations."
 (Wikipedia)

Finally

Select your papers CAREFULLY!

 Only find GOOD papers – published in GOOD outlet and written by GOOD authors – in order to acquire a good literature review.



Creatology

- A new field, slowly developing into a "science"
- Creative acts: when scientists invent
 - new methods of research, new models, new devices
 - New hypothesis, new theories, new experiments
- Founders of new science are often referred to as "fathers" of science.

Gregor Mendel

Norbert Weiner

father of genetics

father of cybernetics

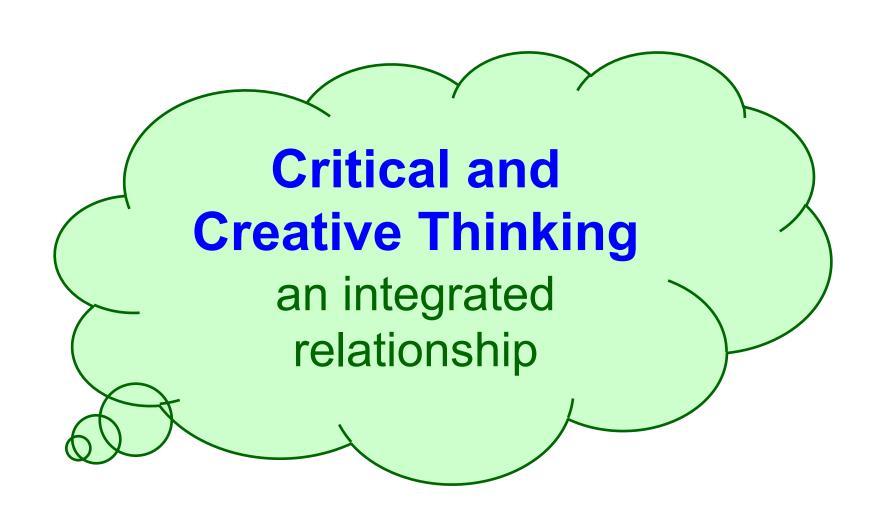
Conclusions from Creatology

Good News:

- Every one of us is creative
- Training can enhance our creativity
- More knowledge does NOT automatically imply higher creative ability

Optional reading:

"Creativity in Science and Engineering"
by Martin Perl
Stanford University, 2007
(Novel Laureate)



Critical Thinking vs Creative Thinking

Critical Thinking	Creative Thinking
Analytical	Generative
Convergent	Divergent
Left brain	Right brain
Logical	Intuitive
Sequential	Imaginative
Objective	Subjective
Reasoning	Speculating
Reality Based	Fantasy Based
Vertical	Lateral
Probability	Possibility
Judgmental	Non-judgmental
Verbal	Visual
Hypothesis testing	Hypothesis forming
Closed-ended	Open-ended
Pattern Users	Pattern Seekers

"The critical & creative functions of the mind are so interwoven

that neither can be separated from the other without essential loss to both."

...anonymous

In Webster's Dictionary of Synonyms

"The word 'critical' when applied to persons who judge and to their judgments, not only *may*, but in very precise use *does*, imply an effort to see a thing clearly and truly so that not only the good in it may be distinguished from the bad and the perfect from the imperfect, but also that it as a whole may be fairly judged and valued."

In Webster's New World Dictionary, the word 'creative' has three interrelated meanings:

- 1. Creating or able to create,
- 2. Having or showing imagination or artistic or intellectual inventiveness
- 3. Stimulating the imagination and inventive powers

Criticality assesses; creativity originates

Critical and creative thought are both achievements of thought.

Creativity masters a process of making or producing

Criticality masters a process of assessing or judging

Intellectual discipline and rigor are at home with originality & productivity

In critical thinking we assess thinking to make improvements.

In creative thinking we generate thinking based on our sense of how to make things better.

Thus, critical thinking has a creative component to produce a better product of thought

And creative thinking has a critical component to reshape thinking in keeping with criteria of excellence.

Will continue to edit the remainder of the slides from here onwards.

https://www.16personalities.com/

Critical thinking without a creative output is merely negative thinking.

Creative thinking without a critical component is merely novel thinking.

It is easy to be merely negative or novel in one's thought.

Achieving quality requires standards of quality – and hence criticality

Achieving useful produces of one's thinking requires a sense of how to make, or recast, one's thinking at a higher level.

To achieve any challenging end, we must have:

criteria, gauges, measures, models, principles, standards, or tests to use in judging whether we are approaching that end.

We don't achieve excellence in thinking with no end in view. We design for a reason

With standards that enable us to generate a product that meets crucial criteria. Our creative thinking must be tested against critical standards.

The generative power of our thought represents its creativity

- The judiciousness of our thought represents its criticality.
- Generativeness must be married to judiciousness to achieve excellence.

A Necessary Condition to the Development of Critical and Creative Thinking is:

A Questioning Mind

