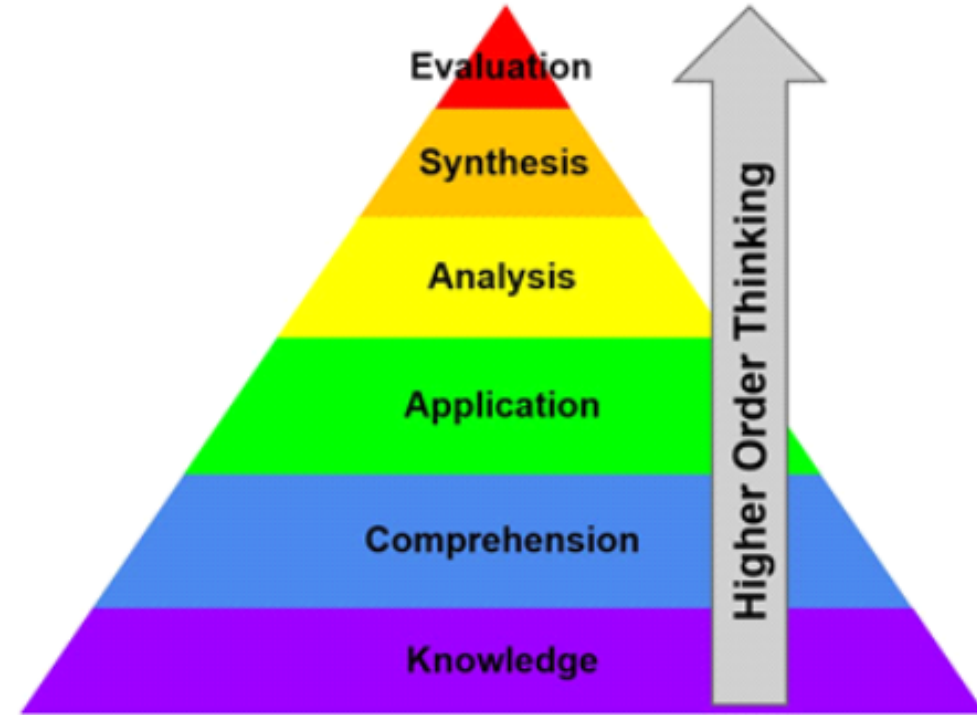


Critical Thinking

“The careful, deliberate determination of whether one should accept, reject, or suspend judgment about a claim and the degree of confidence with which one accepts or rejects it.”

(*Critical Thinking*. B. Moore and R. Parker, 2007)

What are examples of higher order thinking?

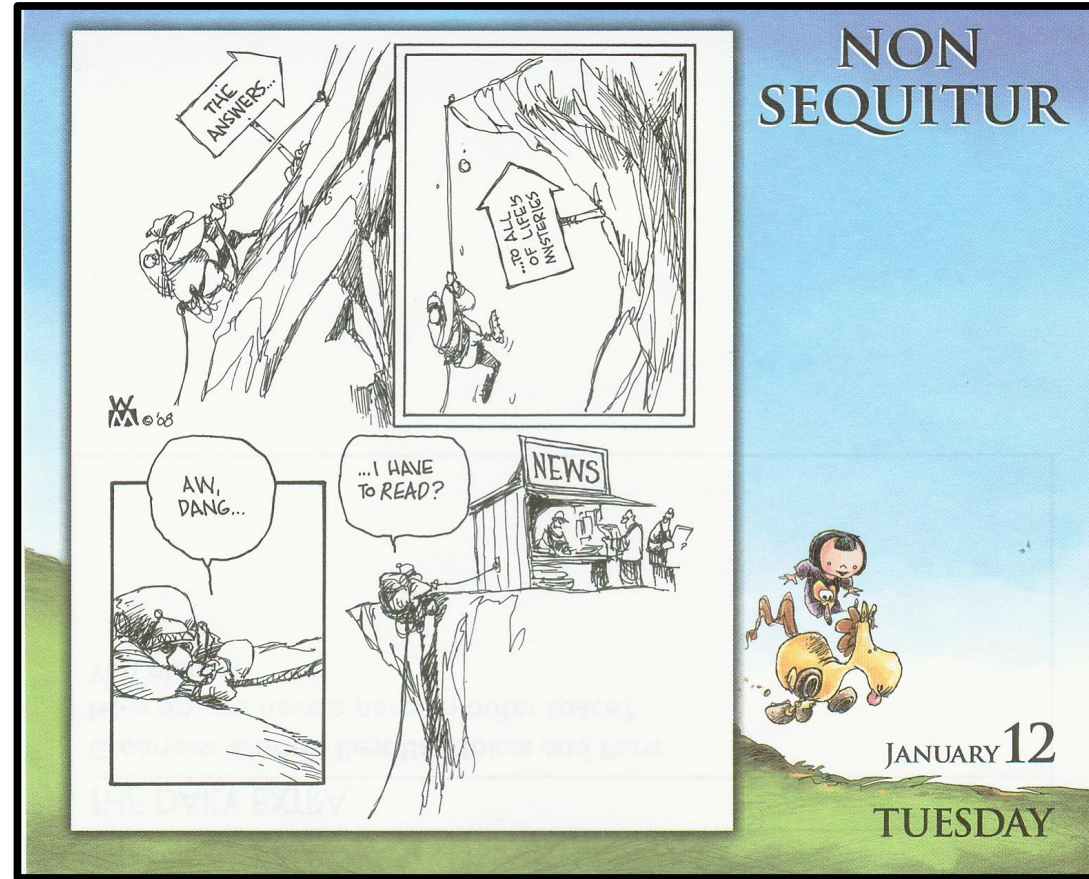


Bloom's Taxonomy
Cognitive Domain

Examples of using Critical Thinking

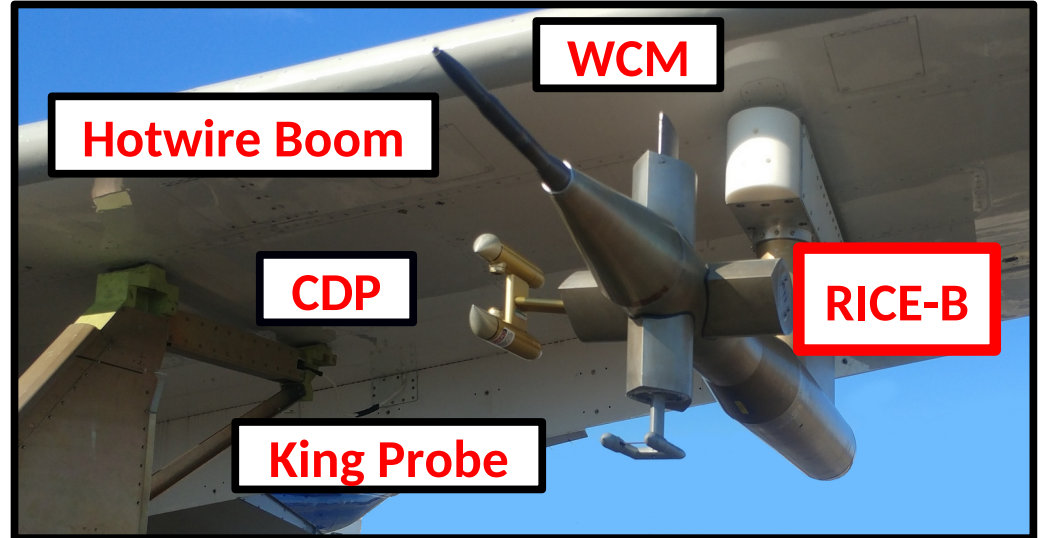
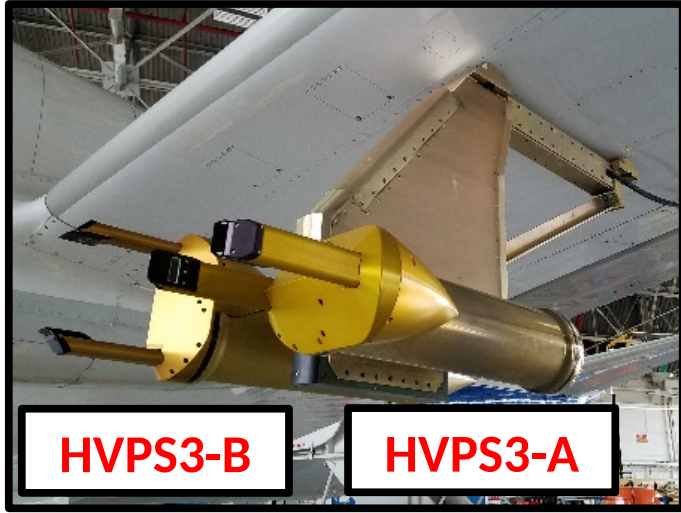
- Approaching Questions
- Solving Problems
- Taking Action

Requires active thinking, the use of reason, and an open mind.



What is an example of how you used critical thinking?

As we Discuss Critical Thinking: How Does it Apply?



Application of Critical Thinking

Critical thinking should be applied to:

- Expressing your own thoughts, beliefs, and opinions.
- Reading or listening to the thoughts, beliefs, opinions of others.



How can you apply critical thinking to class lectures?

Elements of Thought and Reasoning

- It has a purpose.
- It is trying to figure something out.
- It is based on assumptions.
- It is done from some point of view.
- It is based on information.
- It is expressed through concepts & theories.
- It contains interpretation of data and observations.
- It has implications and consequences.

Periodic Table of the Elements

The periodic table is organized into groups (IA to VIIA) and periods (1 to 7). The elements are color-coded based on their properties:

- State of matter (color of name):** GAS (blue), LIQUID (green), SOLID (orange), UNKNOWN (grey).
- Subcategory in the metal-metalloid-nonmetal trend (color of background):** Alkali metals (red), Alkaline earth metals (orange), Transition metals (yellow), Metalloids (green), Nonmetals (blue), Noble gases (purple).
- Unknown chemical properties:** Indicated by a grey background.

Key elements highlighted include Hydrogen (H), Helium (He), Lithium (Li), Beryllium (Be), Sodium (Na), Magnesium (Mg), Potassium (K), Calcium (Ca), Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), Zinc (Zn), Gallium (Ga), Germanium (Ge), Arsenic (As), Selenium (Se), Bromine (Br), Krypton (Kr), Rubidium (Rb), Strontium (Sr), Yttrium (Y), Zirconium (Zr), Niobium (Nb), Molybdenum (Mo), Technetium (Tc), Ruthenium (Ru), Rhodium (Rh), Palladium (Pd), Silver (Ag), Cadmium (Cd), Indium (In), Tin (Sn), Antimony (Sb), Tellurium (Te), Iodine (I), Xenon (Xe), Cesium (Cs), Barium (Ba), Lanthanum (La), Cerium (Ce), Praseodymium (Pr), Neodymium (Nd), Promethium (Pm), Samarium (Sm), Europium (Eu), Gadolinium (Gd), Terbium (Tb), Dysprosium (Dy), Holmium (Ho), Erbium (Er), Thulium (Tm), Ytterbium (Yb), and Lutetium (Lu).

Questions Using Elements of Thought

- Purpose
 - What am I trying to accomplish?
- Questions
 - What question am I raising or addressing?
 - Am I considering the complexities?
- Information
 - What information or experience am I using?
 - What information do I need?
- Inferences/Conclusions
 - How did I reach this conclusion?
 - Is there another interpretation?



Questions Using Elements of Thought

- Concepts
 - What is the main idea?
 - Can I explain it?
- Assumptions
 - What am I taking for granted?
 - What have I assumed?
- Implications/Consequences
 - What am I implying?
- Points of View
 - What point of view am I using?
 - Is there another point of view to consider?



Intellectual Standards

- Clarity – Further elaboration, examples
- Accuracy – Verify, check out
- Precision – More specific, further details
- Relevance – Relate to question
- Depth – Complexities and difficulties
- Breadth – Another perspective, other point of view
- Logic – Makes sense, conclusions follow evidence
- Significance – Central idea, most important facts
- Fairness – Vested interest in the issue



Standards and Elements

- Intellectual Standards should be applied to Elements of Thought.
- This approach can be used to:
 - Analyze contents of an article.
 - Analyze and assess research.
 - Help you formulate your own conclusions.
 - Help you take a reasoned stand on an issue.
- This leads to developing Intellectual Traits.



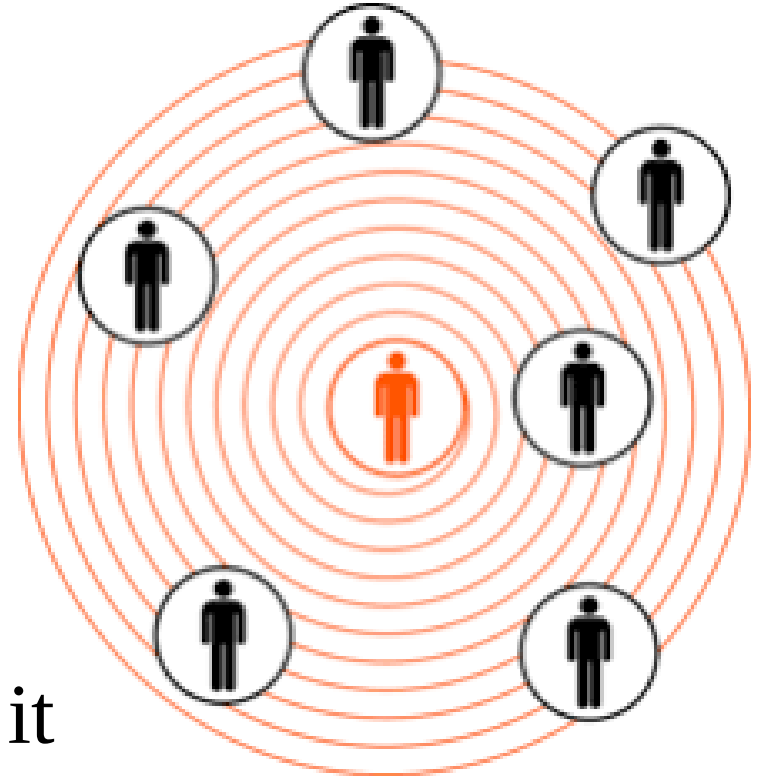
Intellectual Traits

- Intellectual Humility - Realize limits of own knowledge
- Intellectual Courage - Ideas/beliefs/views that counter our own
- Intellectual Empathy - See the other side
- Intellectual Autonomy - Think for yourself
- Intellectual Integrity - Hold yourself to consistent, high standards
- Intellectual Perseverance - Work through confusion
- Confidence in Reason - Believe that high standards will win out
- Fair-mindedness - Treat all viewpoints alike

Egocentric Thinking

It's true because:

- I believe it
- We believe it
- I want to believe it
- I have always believed it
- It is in my own interest to believe it



Apply Critical Thinking to Weather Modification

- Approaching Questions
- Solving Problems
- Taking Action

Requires active thinking, the use of reason, and an open mind.



Image from cloud seeding in North Dakota on July 2, 2012. Credit: David Delene