What is Thinking (Cognition)?

Edward De Bono says that thinking is...

the deliberate exploration of experience for a purpose.

The action of thinking is an exploration, so when one thinks one investigates, studies, examines or analyzes.

The object explored is one’s experience, that is, the collection of events that make up one’s conscious life -- the entire content of one’s conscious mind.

Furthermore, this exploration of experience is deliberate which implies that the action is performed carefully and thoroughly.

And finally the action is carried out for a purpose so there is some goal or aspiration to attain.
Thus thinking is a careful and thorough investigation of the collection of events that make up one’s conscious life in order to achieve a specific objective.
Habits of Mind

...the habits or dispositions of successful people.

Personal Traits
- Persisting
- Managing impulsivity
- Striving for accuracy
- Finding humor

Acquiring Information
- Gathering data through all senses
- Listening with understanding and empathy
- Questioning and posing problems
- Thinking interdependently

Thinking Tools
- Thinking flexibly
- Thinking and communicating with clarity and precision
- Applying past knowledge to new situations
- Remaining open to continuous learning

Personal Responses to Thought
- Creating, imagining, innovating
- Responding with wonderment and awe
- Thinking about thinking (metacognition)
- Taking responsible risks
First Order Abstraction
Processing Ideas

1. Treating facts or ideas as independent entities
   accumulating facts, generating new ideas

2. Simple analysis of collections of facts or ideas
   classify, sequence
   analogy/metaphor, compare/contrast
   parts/whole reasoning

3. More complex analysis
   inference
   causal reasoning
   generalization, prediction
   analogical reasoning
   deduction
   conditional (if ... then)
   categorical (some ... all)

4. Complex cognitive tasks (systematic thinking)
   decision making
   problem solving
   assumptions, order of magnitude estimates
   planning
   modeling and simulation
Second Order Abstraction
Evaluating Ideas

1. Assessing the reasonableness of ideas
   assessing the reliability of information
   accuracy of observation
   reliability of sources

2. Evaluating the utility of ideas

3. Testing conclusions with reality
   uncovering and evaluating assumptions
   hypothesis and testing
   identifying reasons and conclusions

4. Reformulating ideas based upon assessment

5. Evaluation of the human element
   consensus
   personal feelings
Third Order Thinking
Metacognition

1. Being **aware** of the kind of thinking you are doing

2. Knowing the thinking **strategy** you are using.

3. **Evaluating** the effectiveness of your thinking.

4. **Planning** how you will do the same kind of thinking the next time it is needed.
Times to Remember

Sensory Memory
(1 - 2 seconds)

Working Memory
(≈ 18 seconds without attention)

Long Term Memory
(permanent, more or less)

Attention
Rehearsal
Refresh

sight
sound
feel
taste
smell

90 %
Think of an event in your life where you demonstrated persistence and it led to a success.

List the various **skills, attitudes, feelings, strategies** that you utilized in demonstrating your persistence.

Discuss and compare your list with a partner.

Create a composite list.

Share with the group.
Each Habit of Mind, like the Habit of “Persisting”, has a set of skills and strategies.

As skillful thinkers, we need to be aware of those sub-skills so we can support their ongoing development.

When you come to think about your term paper for this class think about what is needed to “persist”

Your goal, sub goals,

Steps to be taken
## Sorting

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<thead>
<tr>
<th>computer worms</th>
<th>AIDS</th>
<th>friend</th>
<th>random</th>
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<tbody>
<tr>
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<td>movies</td>
<td>small world</td>
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</tbody>
</table>
Each Cognitive Skill, like “Classify”, has a plan of action - sometimes called Mind Map, Thinking Map.

As skillful thinkers, we need to be aware of this plan so each time we use the cognitive skill we know how to proceed and we can support its ongoing development.

When you come to think about a topic for your term paper for this class think about how you will classify the various candidate topics before you select the best one.
What is Metacognition

Metacognition refers to the conscious application of an individual’s thinking to their own thought processes with the specific intention of understanding, monitoring, evaluating and regulating those processes.
Thinking and Learning in Concert

By thinking about our thinking we are able to:

• Select from a repertoire of strategies when we are faced with problems or new knowledge and experiences

• Monitor the successfulness of our selection and use of these strategies

• Modify and adapt our selection and use of strategies

Stop and think about what you are doing

Thinking and Learning in Concert
When you think about your own thinking you are thinking about...
Listening with empathy and understanding

Understand Others!

Devoting mental energy to understand another person’s thoughts and ideas: make an effort to perceive another’s point of view and emotions.
CALVIN AND HOBBES

When a person pauses in mid-sentence to choose a word, that's the best time to jump in and change the subject!

It's like an interception in football! You grab the other guy's idea and run the opposite way with it!
The more sentences you complete, the higher your score! The idea is to block the other guy's thoughts and express your own! That's how you win!

Conversations aren't contests!

Ok, a point for you, but I'm still ahead.
Listening Sequence

P P P

Pause
Paraphrase
Probe
Pause

Controls the pace of conversation

Participants listening to each other

Students asking questions

Improves the quality of the discussion

Contributions from all participants

Paraphrase

Lets listeners know:

• that you are listening,
• that you are trying to understand them,
• that you care about their thoughts.
Probe

Probing increases the clarity and precision of thinking by refining understandings, terminology and interpretation.

Pushes the speakers to be more specific: e.g. “it’s really big and stuff”

Encourages higher order thinking: “given what we have just seen happen, what are some of the things that might happen next if we ...?"
How Do You Know?

Having a questioning attitude: knowing what data are needed and developing questioning strategies to produce those data.

Finding problems to solve.
Pythagoras (circa 576 – 495 BC) a Greek philosopher, mathematician and mystic discovered that there was an underlying mathematical pattern to the sensations of music.

He believed that the external world we perceive could be understood in terms of mathematical principles.

"What we perceive we can understand".

He developed a method for approaching this understanding that involves five steps: observation, abstraction, understanding, description and verification.

The detailed conception of the universe we have today is due in large measure to the first steps taken by this Pythagorean school of thought.
Mathematical Modeling

The real world

Making the problem amenable to mathematical treatment

A model of reality

Understanding, structuring and simplifying the situation

A real situation

Validating the results

Real results

Interpreting the mathematical results

The mathematical world

A mathematical model

Using relevant mathematical tools to solve the problem

Mathematical results

Understanding,
structuring and
simplifying the
situation

Real results