UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF MECHANICAL ENGINEERING

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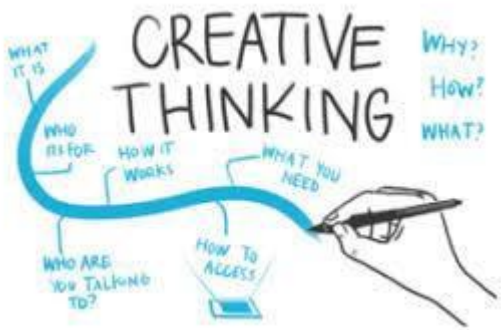

WEEK 11

THINKING SKILLS

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LEARNING OUTCOME

Ability to describe the model of thinking and apply the different types of thinking in the problem solving process

What are THINKING SKILLS?

Thinking is a natural function or believe that the great thinkers among us are gifted. Research shows that each of us has a hugely powerful potential in our brains that lies vastly under-used.

- Potential of the brain (100 billion cells)
- Brain Power (10 billion neurons)
- Exploring the Myths (Intelligence Quotient)
- Brainworks (logical, imaginative, invent, innovate)
- Management thinking (basic facts, understanding, analysis, social skills, creativity, self-knowledge.)
- Key-points, (breaking down into points)

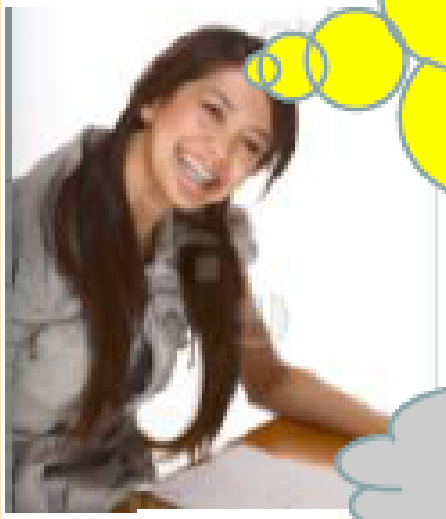
THINKING

Knowledge

- "Thought is the key to knowledge.
- Knowledge is
  - *discovered by thinking*
  - *analyzed by thinking*
  - *organized by thinking*
  - *transformed by thinking*
  - *assessed by thinking*
  - *and, most importantly, acquired by thinking." (Paul, 1993 vii)

Thinking is the conscious and goal-directed mental activity we do in order to **solve problems**

The Thinking Process



This involves **Critical Thinking –** have I seen this problem before, what are the likely causes, what information do I need to clearly interpret what's occurring....?

Good thinking, what's that?

I want good Thinking on this

Model of Learning

- MUDD
  - memory, understanding, doing, desire

Model of Learning

- Memory: involves association, repetition, review, paraphrasing and self-testing

- Understanding: making sense of information, extracting meaning and relating information to the realities of everyday life. Understanding involves *questioning, comparing, contrasting, analysis, synthesis, evaluation, acquiring insight and problem-solving*

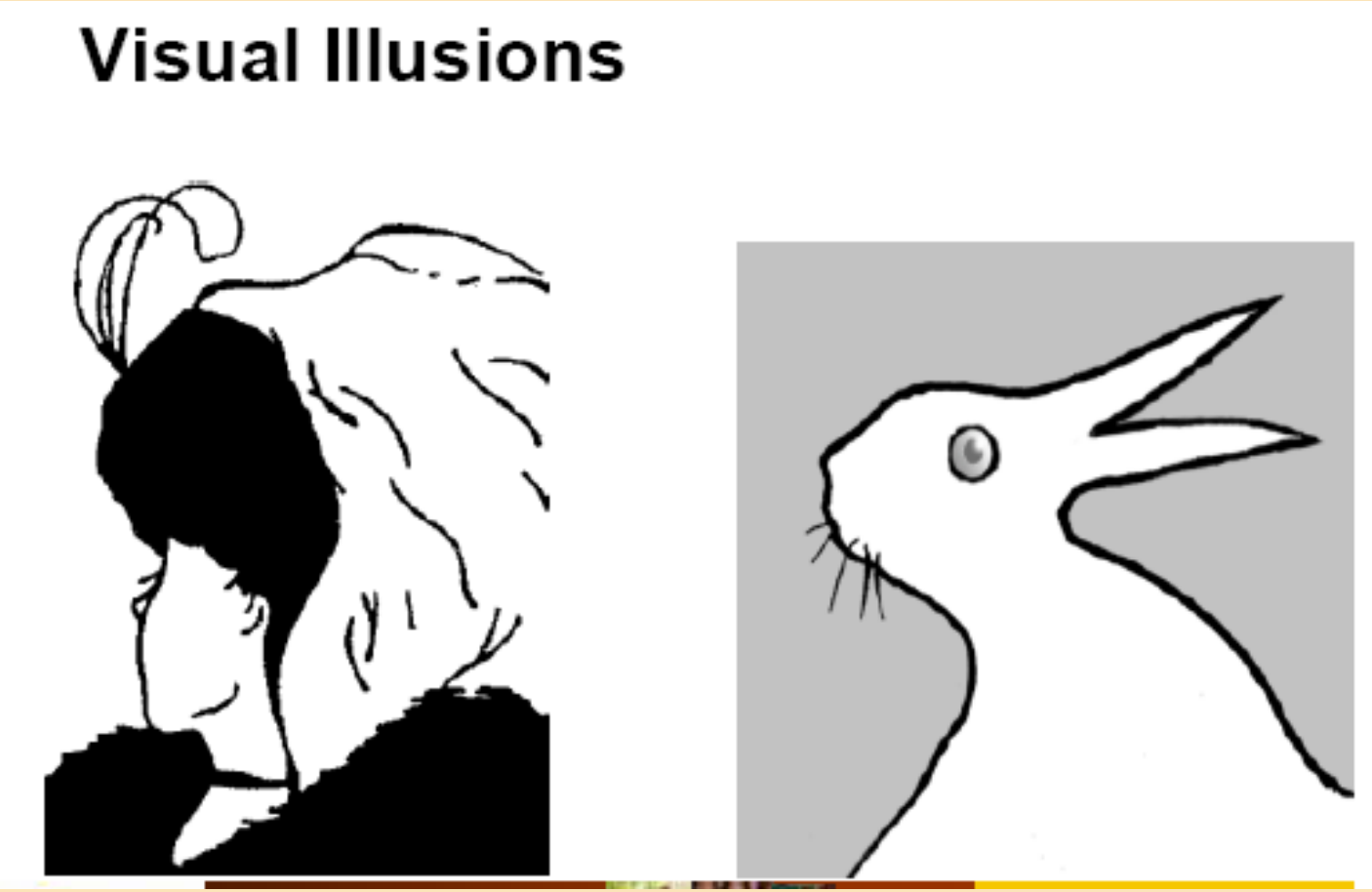
The Thinking Process

- Essential knowledge – facts, concepts, principles, procedures

The Thinking Process

- Barriers to good thinking
  - habits of perception (beliefs, preconceive ideas, visual or mental illusions)
  - Restricted working memory (7±2 bits)
  - Slow conscious processing speed

Different people see things differently

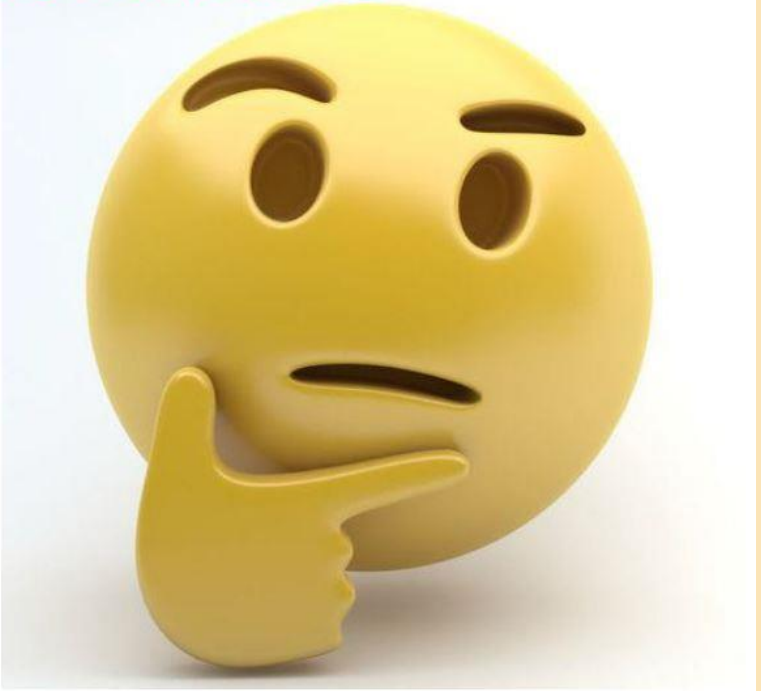


Types of Thinking

- Creative Thinking
- Critical Thinking
- Meta-Cognitive (Thinking about thinking)

How do we put these in perspective….so we can apply them in problem solving?

What we need is...
A MODEL OF THINKING



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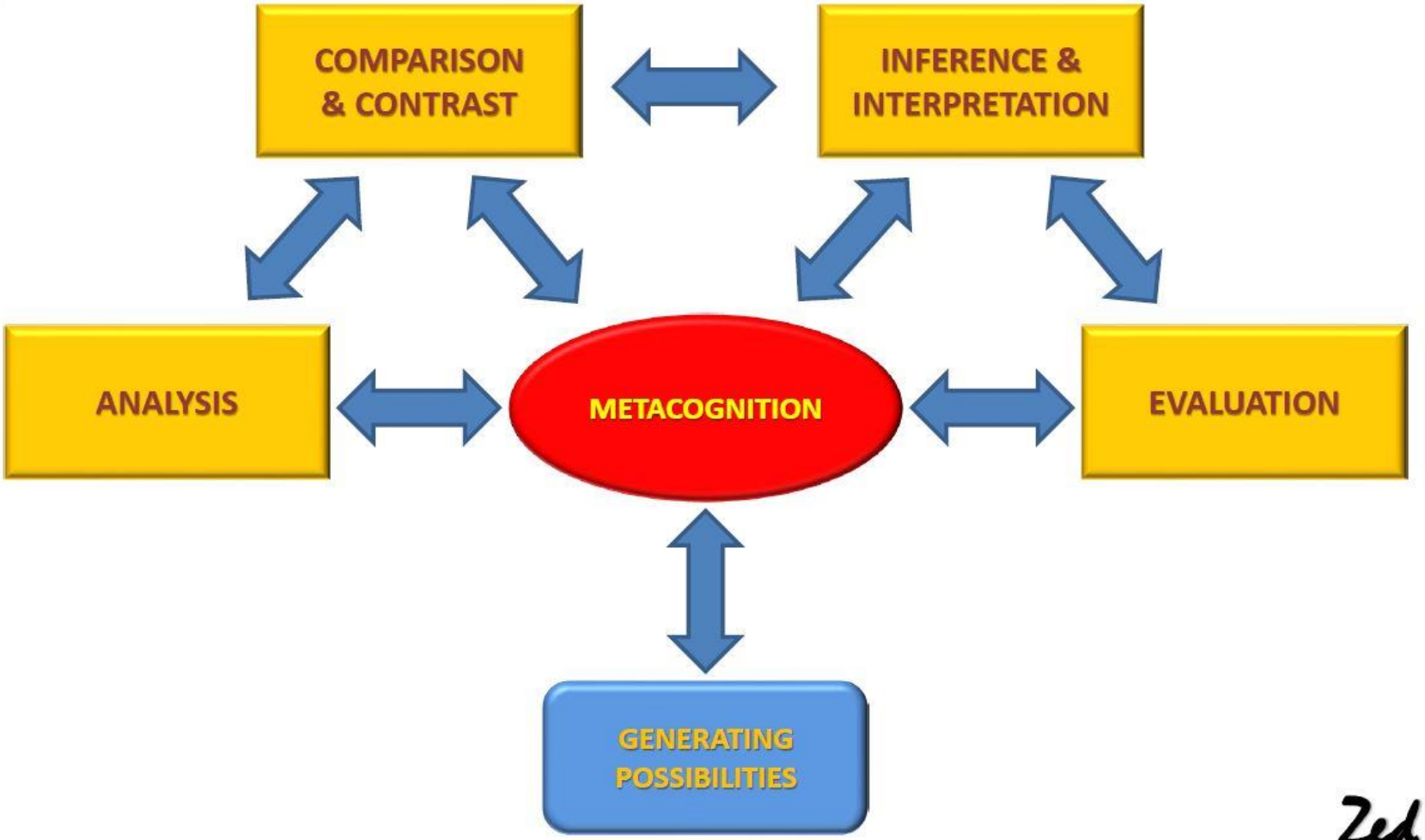
A MODEL OF THINKING



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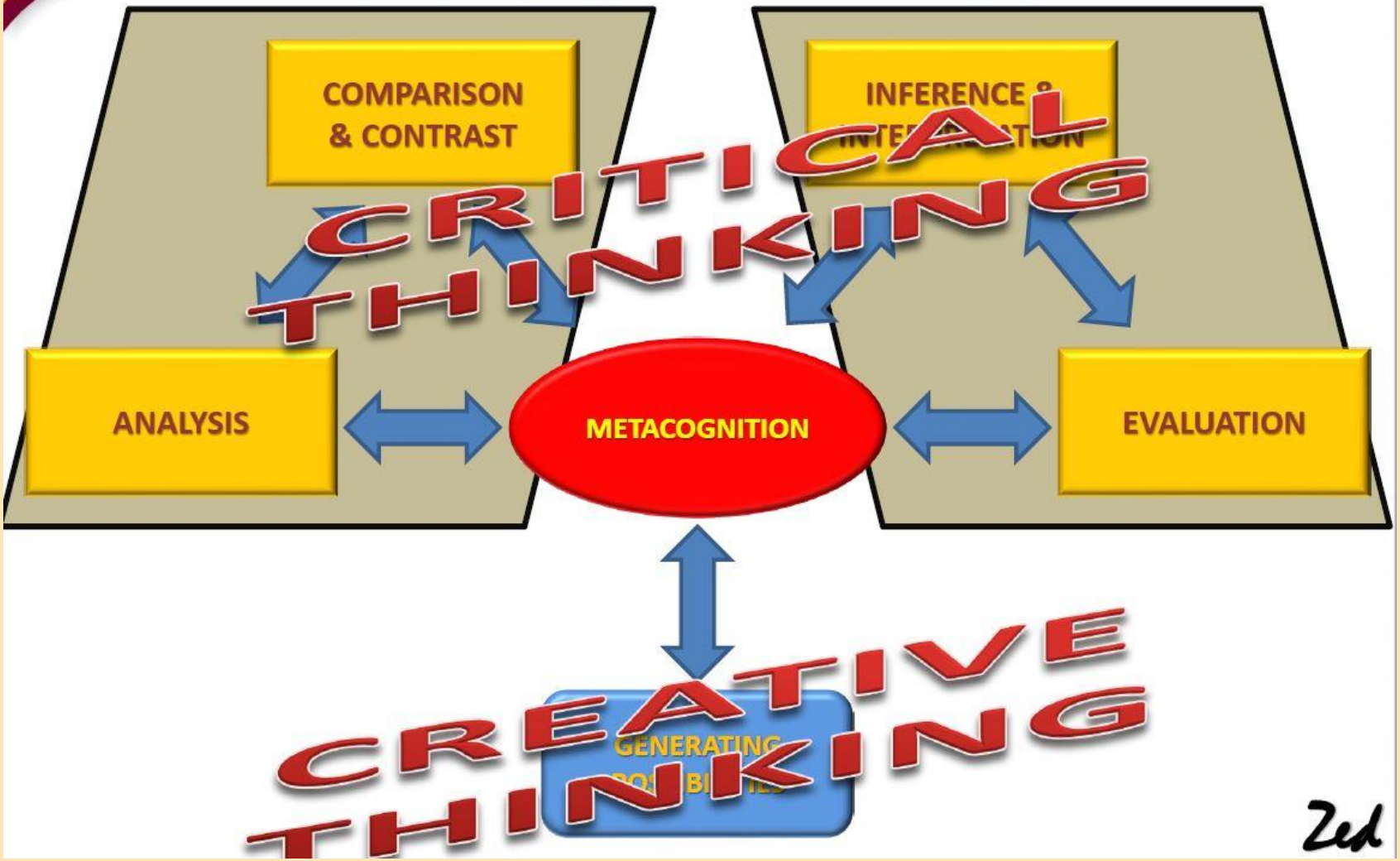
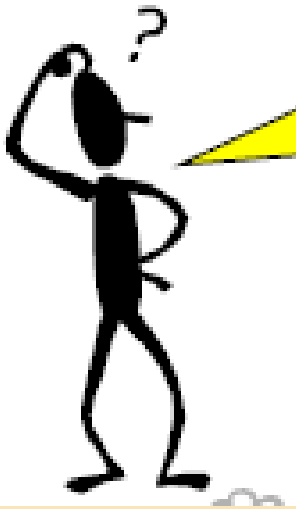
TYPES OF THINKING

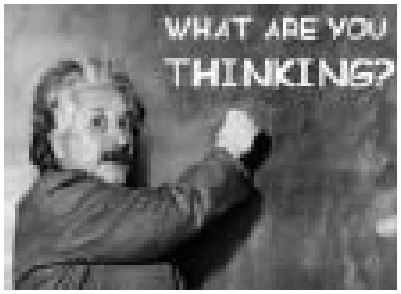


Creative Thinking

Generating Possibilities



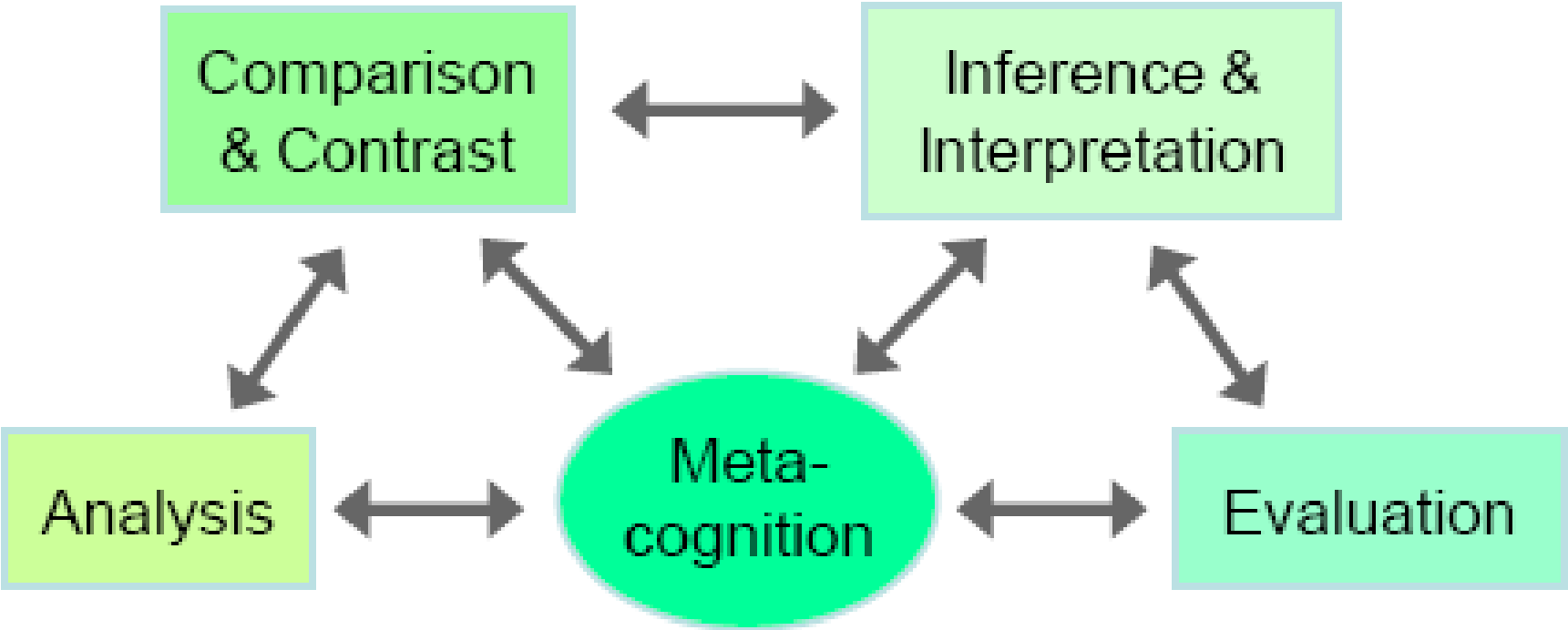
What do we do when we generate possibilities?



- Generate many possibilities
- Generate different types of possibilities
- Generate novel possibilities

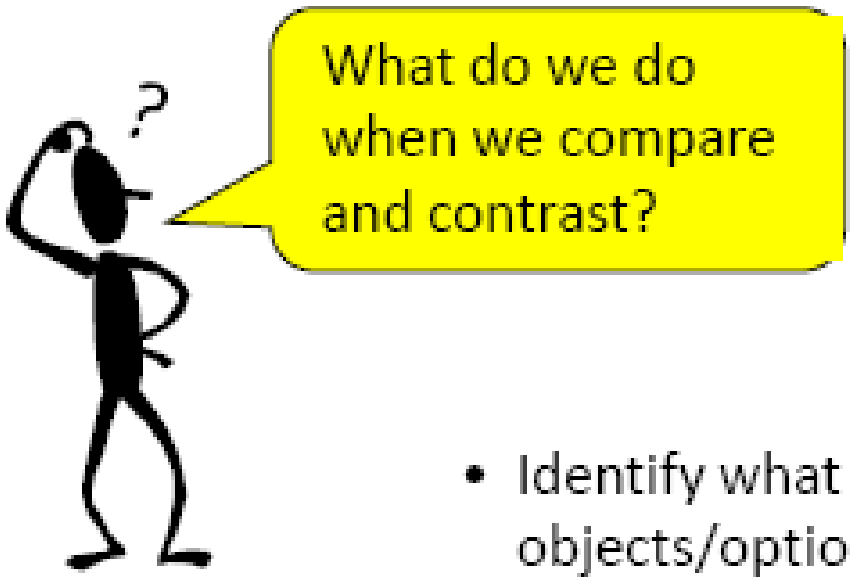
All creative products involve the combining of old ideas or elements in new ways

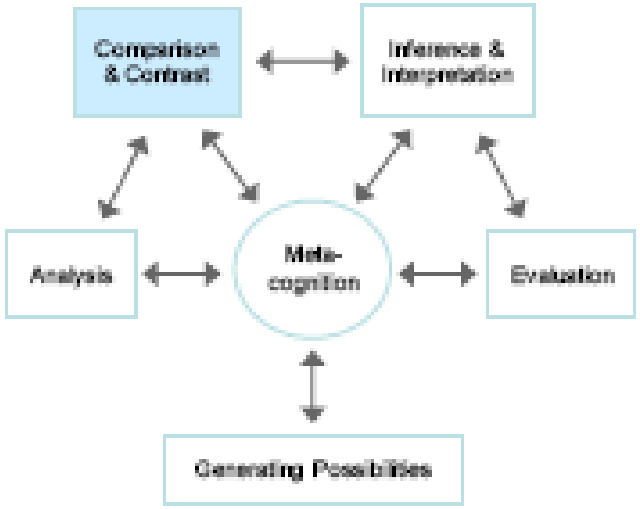
Critical Thinking

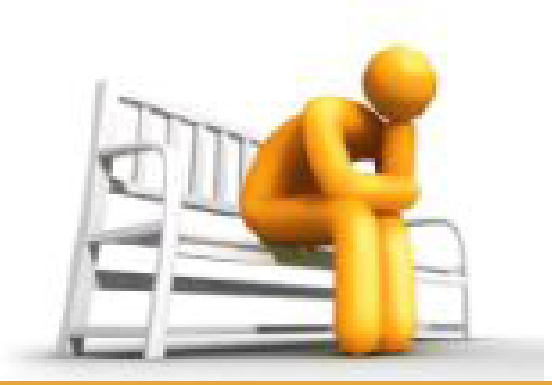


Critical Thinking

Comparison and Contrast





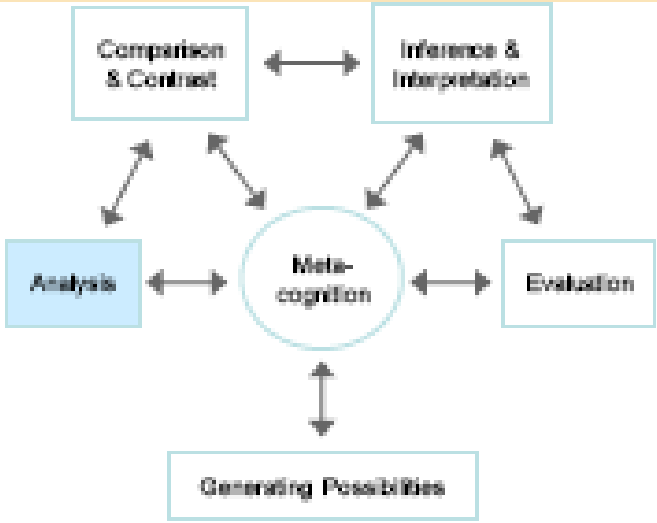


- Identify what is similar between things - objects/options/ideas, etc
- Identify what is different between things
- Identify and consider what is important about both the similarities and differences
- Identify a range of situations when the different features are applicable

Critical Thinking

Analysis

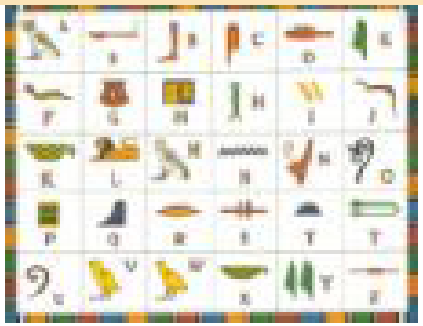
What do we do when we analyse?



- Identify relationship of the parts to a whole in system /structure/model
- Identify functions of each part
- Identify consequences to the whole, if a part was missing
- Identify what collections of parts form important sub-systems of the whole
- Identify if and how certain parts have a synergetic effect

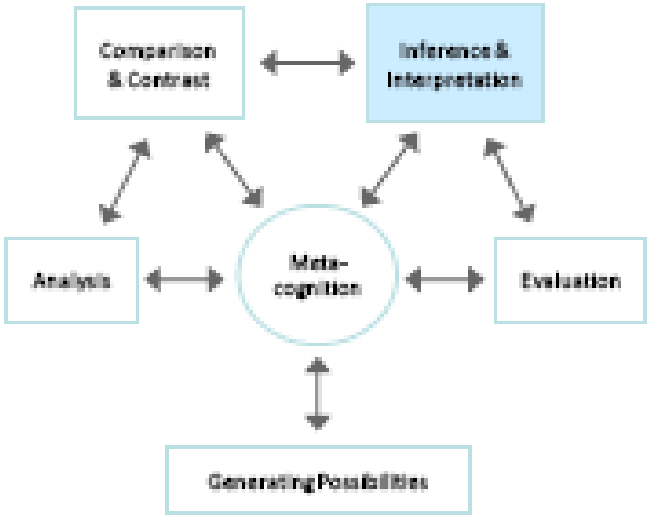
Critical Thinking

Inference and Interpretation



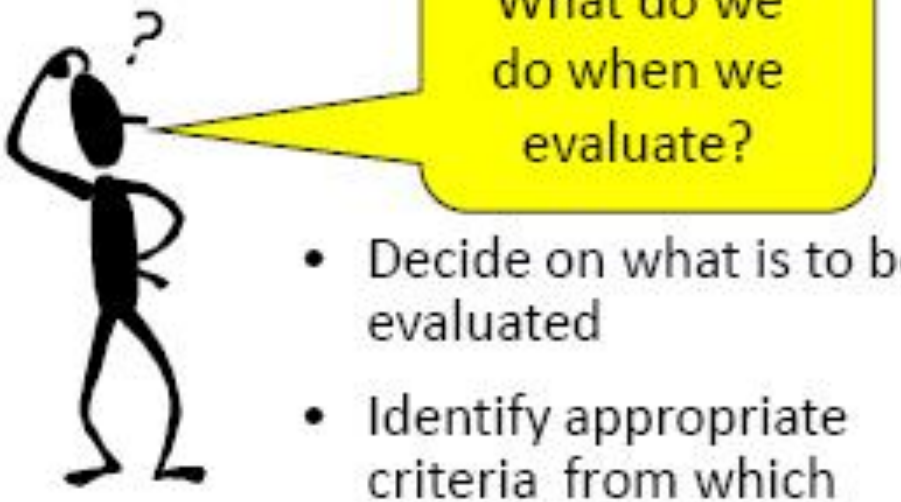
What do we do when we make inferences and interpretations?

- Identify intentions and assumptions in data
- Separate fact from opinion in data
- Identify key points, connections, and contradictions in data
- Make meaning of the data/information available
- Establish a best picture to make predictions

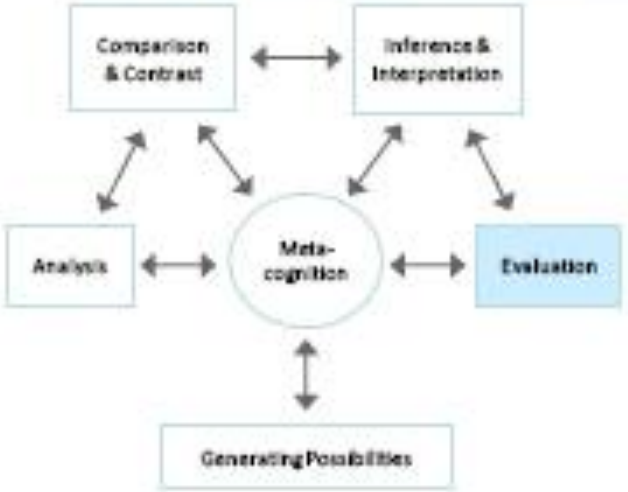


Critical Thinking

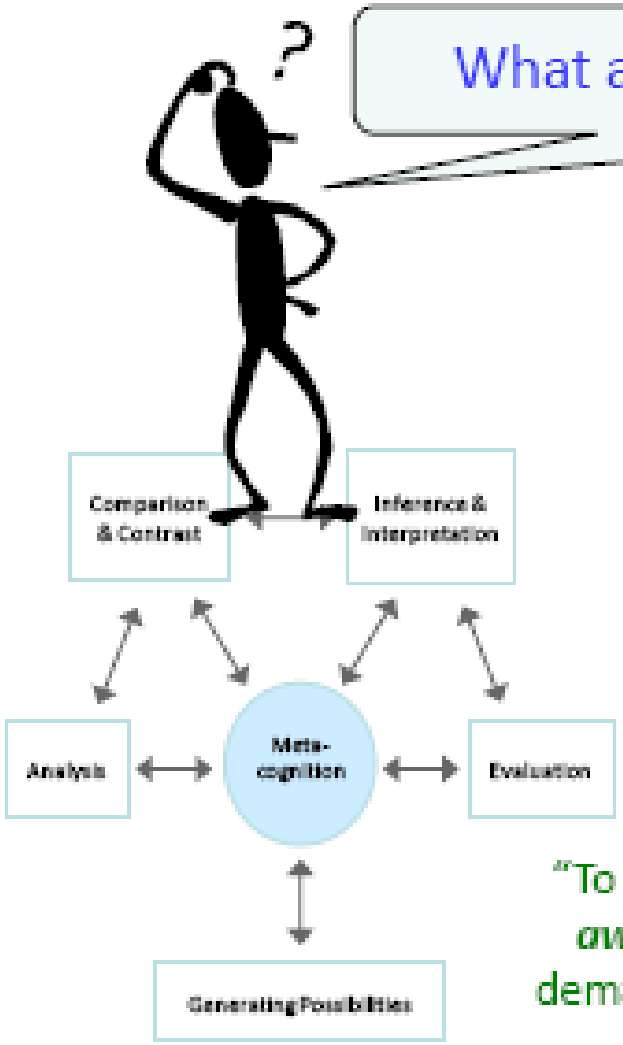
Evaluation



- Decide on what is to be evaluated
- Identify appropriate criteria from which evaluation can be made
- Prioritize the importance of the criteria
- Apply the criteria and make decision



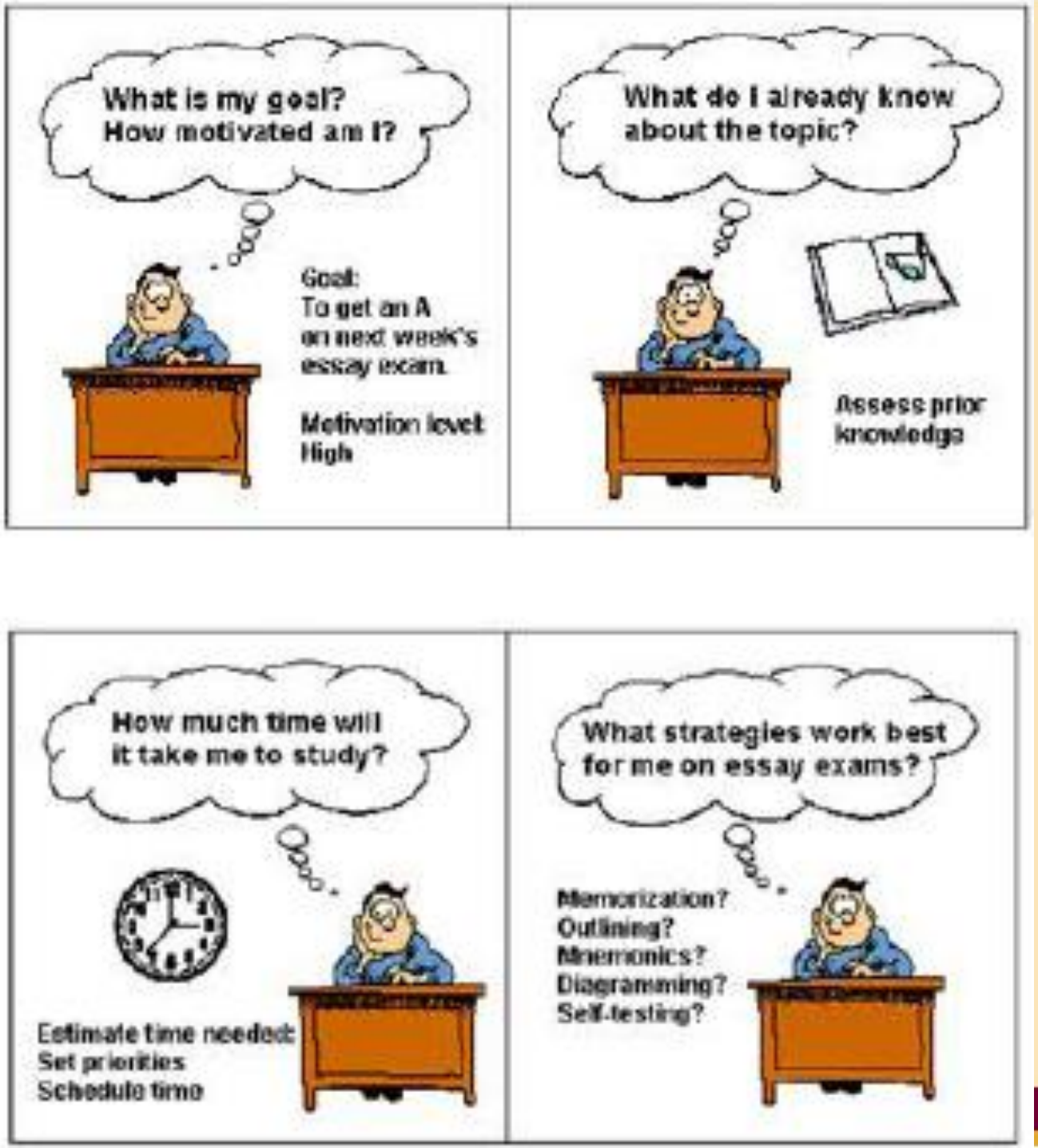
Meta-cognition



- Aware that we can think in an organized manner
- Actively thinking about the ways in which we are thinking
- Monitoring and evaluating how effective we are thinking
- Seeking to make more effective use of the different ways of thinking as well as any useful learning strategies, tools and resources

"To be properly metacognitive…students have to be realistically ***aware*** of their own cognitive resources in relation to the task demands, and then to plan, monitor, and control those resources"

(Biggs, 1987)


What is my goal?
How motivated am I?
Goal:
To get an A
on next week's
essay exam
Motivation level
High
What do I already know
about the topic?
Assess prior
knowledge
How much time will
it take me to study?
Estimate time needed
Set priorities
Schedule time
What strategies work best
for me on essay exams?
Memorization?
Outlining?
Mnemonics?
Diagramming?
Self-testing?

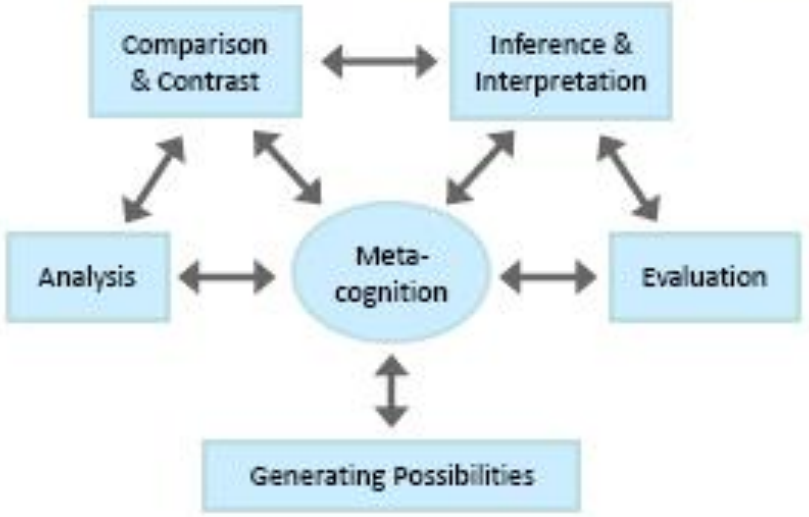
What is Good Thinking?

Good Thinking is…

… the ability to use the six types of thinking in an highly competent manner to solve problems:

This involves:

- Using each type of thinking effectively and efficiently
- Using the 6 types simultaneously, in unison and synergistically



The Key to Good Thinking

From a learners perspective

- Use the 6 types of thinking deliberately and consciously for at least 20 days - until they become a habit
- Continually be aware that you will need to do other things equally deliberately and consciously:
  - Manage and motivate yourself – no desire, no great learning
  - Be straight and honest with yourself - be prepared to develop other necessary skills and work hard at reframing any negative beliefs
  - Put in plenty of effort to acquire the necessary content knowledge (good thinking requires a sound knowledge base)
  - Use a range of thinking tools to help direct and organize your thinking where useful

Have a good thinking about what we have discussed…..

And

USE IT