

# Habits of Mind



## Thinking About Thinking (Metacognition)

### Students' Handout

Name : \_\_\_\_\_

Class : \_\_\_\_\_

*We must ask where we are and wither we are tending.*  
Abraham Lincoln

*Nothing is more terrible than activity without insight.*  
Thomas Carlyle

*It's what you learn after you know it all that counts.*  
John Wonder

## **METACOGNITION**

### **What is Metacognition?**

*Metacognition* means being conscious of one's own thought processes, as a spectator watches a spectacle, combined with the ability to monitor one's flow of thought consciously. *Cognition* means knowing, while metacognition implies a self-conscious awareness about how one learns.

### **An illustration**

Think about a time when you were reading and as you got to the bottom of a page of text, a little voice inside your head said, "I don't know what I just read." With this awareness of knowing what you don't know, you quickly return to where you have lost contact, and re-read the paragraphs in the page and scanning through them looking for key words to capture the meaning and go on. This awareness – knowing what you know and what you don't and the strategy of recovery are what we call metacognition.

A reader who reads and reads and reads and doesn't know that he doesn't is not using metacognition. The key to metacognitive behaviour is this self-awareness of one's own thinking and learning. "Once you know, you can't not know" and, in fact, you can then adjust accordingly. So metacognition is awareness and control over your own thinking behaviour.

Students who are not metacognitive just do things without knowing why. Such students seldom plan ahead and often cannot explain or describe, the steps involved in tasks they are working on. They also seldom question themselves about their own learning strategies or evaluate the efficiency of their own performance.

### **The 3 Basic Elements**

Metacognition consists of three basic elements:

- a) Planning – looking ahead and preparing for written or verbal communication.
- b) Self-monitoring – checking your comprehension while listening or reading.
- c) Self-evaluation – checking your learning against a standard.

Metacognitive learners ask themselves and answer questions like:

- *Why am I doing this? Why is it important? Which of my prior knowledge will help me with this particular task? How much time do I need to set aside to learn this?*  
(Planning)
- *Do I understand what I am reading or hearing? How am I doing? Should I adjust my pace or move in a different direction? What do I need to do if I do not understand?*  
(Self-monitoring)
- *How can I measure my success? How well did I do? What could I have done differently? How might I apply this line of thinking to other problems?*  
(Self-evaluation)

### **The metacognitive mirrors<sup>1</sup> – a metaphor**

The concept of metacognition is like a mirror, because both illuminate flaws as well as positive attributes, change with time, and provide not only first glimpses but second looks.

There are three types of mirrors that seem respectively appropriate to the various types of metacognitive reflection.

1) *The full-length mirror*

The mirrors for reflective planning are the full-length mirrors which provide full exposure to all angles – quite a necessary view as one lays out plans, trying to anticipate the many facets of an idea.

2) *The rear view and side view mirrors of a car*

These mirrors are for reflective monitoring, allowing clear sightings as one proceeds along a chosen path. They are personally positioned by the drivers to provide the needed perspectives to guide progress, signal the need for adjustments, and allow for margins of error in each particular situation.

3) *The hand-held mirror*

Most appropriate for reflective evaluation. This hand-held mirror enlarges the selected image for careful scrutiny and close microscopic evaluation. With this larger-than-life view, reflections are easily inspected for subtle flaws or positive characteristics.

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<sup>1</sup> Taken from Robin Fogarty, *The Mindful School: How to Teach for Metacognitive Reflection*, (1994) Pearson Skylight Publishing, Inc

## **Lesson 2 – Tower Challenge Instructions**

### ***Aim***

To build the tallest free-standing tower that can be stable for at least 30 seconds using only the given materials.

### ***Instructions:***

1. Do not straight away jump into building the tower.
2. Look at the list of materials given.
3. Ask questions.
4. Brainstorm with your group.
5. Take about 5 – 10 min to come up with an action plan.
6. One member must write down the action plan clearly on one of a given sheet of A4 paper as the group discusses. (You may include your methods to make the tower, diagrams of the base and the final tower.)
7. Once you are ready with the action plan, show it to your teacher. The materials will then be given to you and you can start building your tower.

### ***Materials provided:***

- 1 sheet A4 paper for action plan
- 5 sheets of newspapers
- 3 sheets of magazine paper
- 1 roll of sticky tape
- 1 pair of scissors

You have 20 minutes to come up with action plan and build tower.

### ***Remember***

*Failing to plan means you are planning to fail.*

## **Lesson 2 : Tower Challenge Reflections**

<b>1. Refer to your group's action plan</b>	<b>Yes</b>	<b>No</b>
- Did the plan give you a clear idea of what to do before you started building?		
- Did your group spend at least 5 minutes on the action plan?		
- Are the diagrams of the structure and /or base included in your action plan?		

<b>2. While your group was building the structure</b>	<b>Yes</b>	<b>No</b>
- Did you follow your action plan step by step?		
- Were there any unexpected problems while building the tower? If yes, state them in the space below :		
- Did you find your action plan useful?		

### **Evaluation...**

If you were given another chance to build the tower, what would you have done differently? Explain at least 3 changes you would like to make.

**Here are some puzzles you can try on your own.  
When you think about your strategies to solve the puzzles, you are practicing metacognition! Have fun!**

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**Puzzle 1 : Three Men and a Hotel Room**

Three men decided to split the cost of a hotel room. The hotel manager gave them a price of \$30. The men split the bill evenly, each paying \$10, and retired to their room.



However the manager realized that it was a Wednesday night, which meant the hotel had a special: rooms were only \$25. He had overcharged them \$5!

He promptly called the bellboy, gave him five one-dollar bills and told him to return it to the men. When the bellboy explained the situation to the men, they were so pleased at the honesty of the establishment that they promptly tipped the bellboy \$2 of the \$5 he had returned and each kept \$1 for himself.

**The Problem :**

Each of the three men ended up paying \$9 (their original \$10, minus \$1 back) totalling \$27, plus \$2 for the bellboy makes \$29. Where did the extra dollar go?

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**Puzzle 2 : The farmer**

A farmer is returning from the market where he had bought a goat, a wolf and a cabbage. On the way home, he must cross a river. His boat is very small, allowing him only to take one of the three items at a time.

He can't keep the goat and the cabbage together because the goat will eat the cabbage. Similarly, he cannot keep the wolf and the goat together because the goat will be eaten.

**The Problem :**

How can the farmer get everything onto the other side of the river without any harm?

### **Puzzle 3 : The 5 Neighbours**

**Here are the facts about 5 neighbours.**

1. The teacher lives in the red house.
2. The engineer owns the microscope.
3. Coffee is drunk in the green house.
4. The architect drinks tea.
5. The green house is immediately to the right of the white house.
6. The baseball player owns a video camera.
7. The golfer lives in the yellow house.
8. Milk is drunk in the middle house.
9. The mechanic lives in the first house on the left.
10. The man who plays football lives in the house next to the man with the laser player.
11. Golf is played by the man living in the house next to the house where the robot is kept.
12. The tennis player drinks orange juice.
13. The technician plays soccer.
14. The mechanic lives next to the blue house.

From the facts above, can you tell :

**15. who owns the computer?**

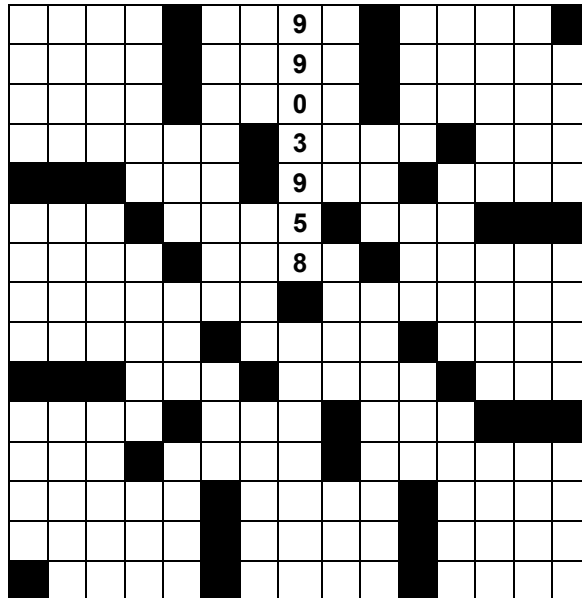
**16. who drinks wine?**

*Use the organizer below to help you – fill in the blanks with the facts above in order to discover where to place last 2 facts (No. 15 and 16)*

	House				
	1	2	3	4	5
Colour					
Occupation					
Sport					
Drink					
Item					

**Puzzle 4 : Number Fill-it-in**

1. Solve this puzzle by filling the numbers into the diagram. Cross out each number that you fill as you go along. While filling the numbers ACROSS, be sure to cross out the DOWN numbers that may be automatically be filled in at the same time.
2. The number list is grouped according to the number of digits and each group is in numerical order.
3. To help you out, one of the numbers have been filled in for you.

**3 NUMBERS**

033  
124  
214  
222  
230  
283  
395  
404  
446  
476  
496  
524  
571  
589  
690  
706  
803  
829  
932  
962

**4 NUMBERS**

0942  
1462  
1603  
1798  
2162  
2591  
3607  
3727  
3852  
3999  
4027  
4042  
4109  
4601  
4650  
5072  
5262  
5572  
5597  
5621

**5 NUMBERS**

5903  
6106  
6458  
6775  
6799  
7004  
7089  
7091  
7297  
7382  
8459  
8467  
8661  
8916  
8963  
9194  
9413  
9503  
9536  
9559  
9872

**6 NUMBERS**

06419  
17010  
21328  
33395  
34425  
50422  
61383  
79796  
79986  
80979  
81116  
84478  
90453  
91816  
92938  
93969

**7 NUMBERS**

314271  
330334  
1437015  
1901969  
7161594  
~~9903958~~

**8 NUMBERS**

48653699  
56413776



**Puzzle Answers**

**Puzzle 1**

The faulty reasoning lies in the addition at the end.

$3 \times \$9 = \$27$ , but the \$2 is already included in this \$27, so it makes no sense to add \$2 to \$27 to make \$29.

They paid \$25 for the hotel room, \$2 for the tip (\$27), and then got \$1 back each to make the original \$30.

**Puzzle 2**

Let the farmer, wolf, goat and cabbage be at Point A and the other side of the river be Point B. The farmer should :

- Take the goat to the Point B first.
- Return to Point A and take the cabbage to Point B.
- Leave the cabbage at Point B and take the goat back to Point A.
- Leave the goat at Point A and take the wolf over to Point B.
- Leave the wolf and cabbage at Point B and go back to Point A to get the goat.

**Puzzle 3**

	House				
	1	2	3	4	5
Colour	Yellow	Blue	Red	White	Green
Occupation	Mechanic	Architect	Teacher	Engineer	Technician
Sport	Golfer	Football Player	Baseball Player	Tennis Player	Soccer Player
Drink	<b>Wine</b>	Tea	Milk	Orange Juice	Coffee
Item	Laser Player	Robot	Video Camera	Microscope	<b>Computer</b>

**Puzzle 4**

9	8	7	2		5	5	9	7		7	2	9	7	
4	6	0	1		6	7	9	9		3	3	3	9	5
1	6	0	3		4	1	0	9		8	0	9	7	9
3	1	4	2	7	1		3	8	5	2		6	9	0
			8	0	3		9	6	2		8	9	6	3
8	2	9		6	7	7	5		4	0	4			
9	5	5	9		7	0	8	9		3	4	4	2	5
1	9	0	1	9	6	9		1	4	3	7	0	1	5
6	1	3	8	3		1	7	9	8		8	4	6	7
			1	2	4		1	4	6	2		2	2	2
6	1	0	6		4	9	6		5	8	9			
4	7	6		5	6	2	1		3	3	0	3	3	4
5	0	4	2	2		9	5	3	6		4	6	5	0
8	1	1	1	6		3	9	9	9		5	0	7	2
	0	9	4	2		8	4	5	9		3	7	2	7