Critical Thinking & Creative Problem Solving

By

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Course Description

- This course introduces to the students the following topics:

- Brain's structure and functions.
- Creativity process and problem solving.
- Critical thinking and critical skills.
- Barriers to creativity.
- Barriers to critical thinking

Learning objectives

1. Understanding the brain main structure.
2. Understanding the brain main functions:

A. Left brain functions: upper and lower sides.

B. Right brain functions: upper and lower sides.

3. Be familiar with the:

"The Four-Quadrant Brain Model of Thinking Preferences" (Whole Brain).

Continue

4. To be familiar with the **"Whole Brain"** Concept.
5. To be able to implement the whole brain concept in practicing critical thinking & creativity.
6. To understand the creativity process and skills.
7. To understand critical thinking concept and skills.
8. To improve your creativity and critical thinking and skills.
9. To understand barriers to creativity.
10. To be able to detect creativity barriers and overcome them.

Introduction

- Why this course for ENSIA students?
- The importance of skills of future employment.
- The World is competing for Human Resources and natural resources.
- Human resources are more important.

International reports about the importance of soft skills

- Foundation for Young Australians (2016). -- Big data analysis reveals the skills young people need for the New Work Order.

http://www.fya.org.au/wp-content/uploads/2016/04/The-New-Basics_Web_Final.pdf

- The “Enterprise Skills” for future work are:

Problem Solving skills, Communication skills, Digital skills, Team Work skills, Critical Thinking skills, Creativity skills and Finance skills.

Continued

- The World Economic Forum Report in 2016:
- The Future Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution.
- Changing the educational systems.
- https://reports.weforum.org/future-of-jobs-2016/

Brain Structure & Functions

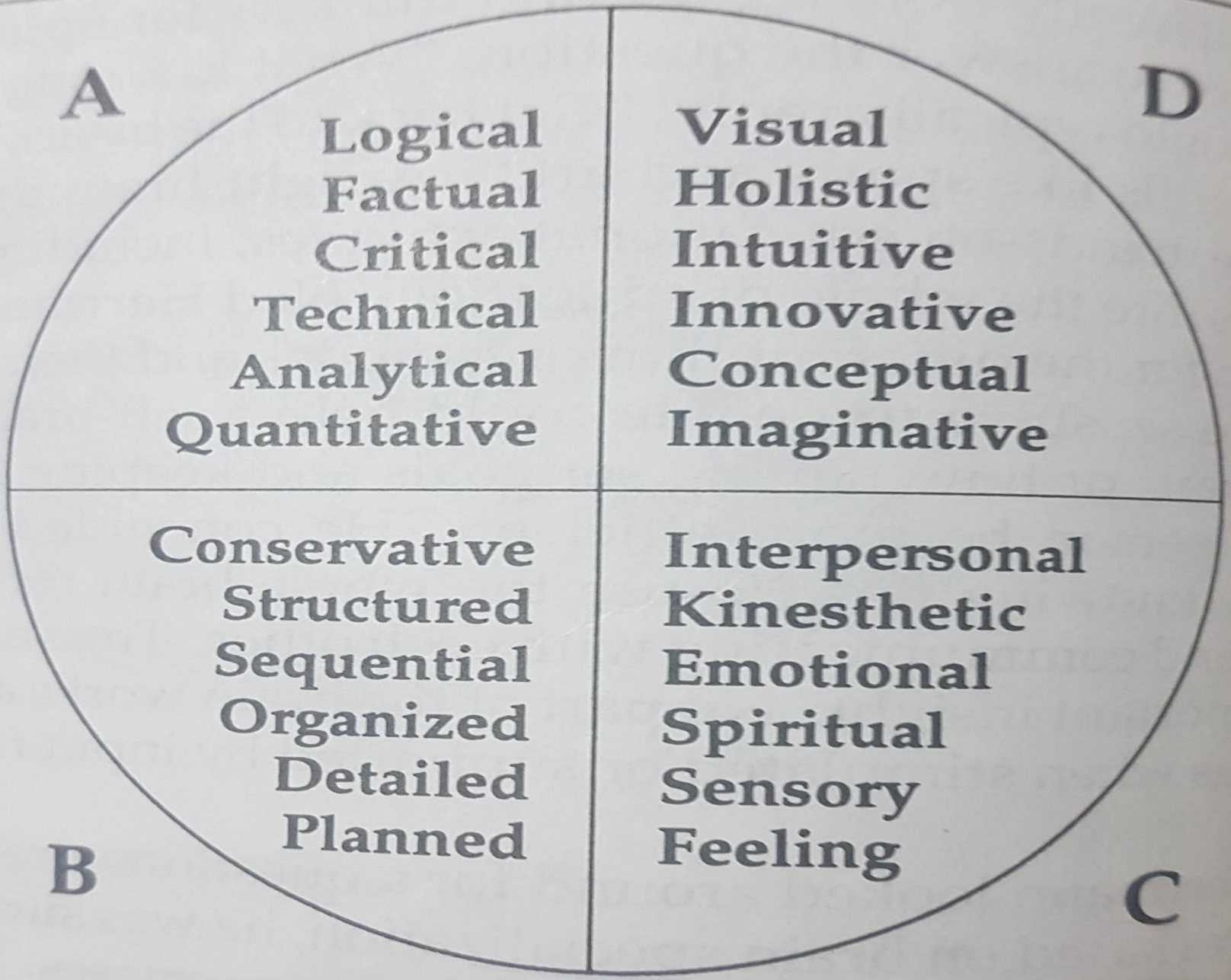
- Relationship between the brain & skills.
- Learning is neuron connections.
- What is the structure of the human brain?
- What are the functions of the human brain?

Neurons

- The brain is consisted of billions of neurons
- Neurons are brain cells.
- How much of our brain we use?
- Don’t forget the heart !!

The Four-Quadrant Brain Model of Thinking

- Brain as a structure, and functions.



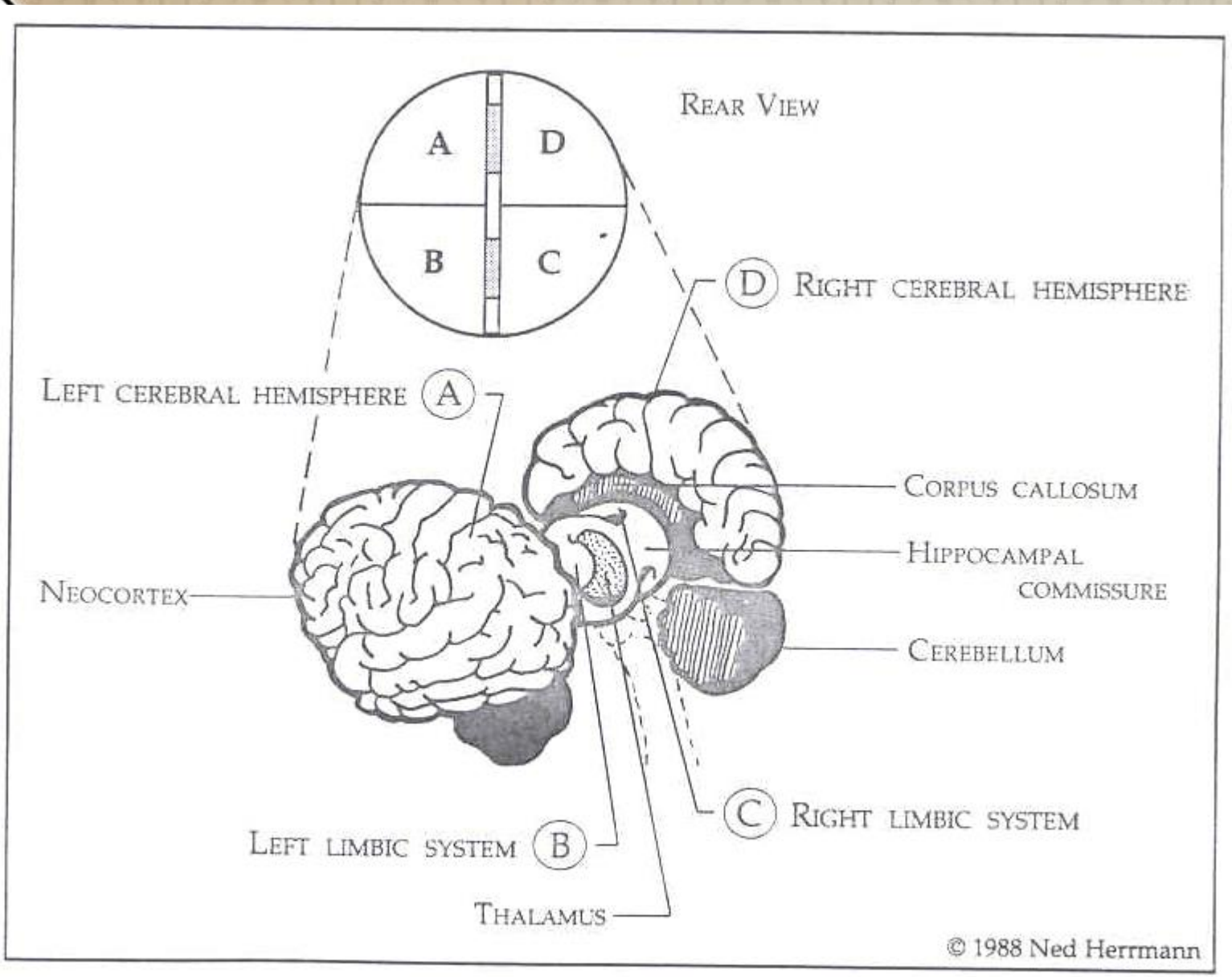


Figure 3-1 How the four-quadrant model relates to the physical brain.

The Four-Quadrant Brain Model of Thinking Preferences

- **Dr. Sperry won the Noble prize on 1981 on the functions of the brain.**

- Neuro-psychology has found that for most people:

1- Mathematical and verbal thinking are in the left hemisphere.

2- Spatial, holistic and imaginative thinking is in the right hemisphere.

- **In 1986, Hermann *observed that the brain is a specialized organ.***

The Concept of Brain Dominance

- The two halves of the brain are not used by People in the same way and with the same frequency.

- People develop dominance: Left brain dominance / right brain dominance.

- People use their dominant mode when they need to solve a problem or learn something new.

1- *Left Brain approach depends on:* Solving a problem analytically by looking at facts & numbers and putting everything into a logical formula or sequential procedure.

2- *Right Brain approach depends on*: Searching patterns and images involving sensory impressions in order to get an intuitive understanding of the whole problem.

The whole Brain Concept

- Develop the whole brain thinking in order to be:

- More critical (upper left brain),
- More creative (upper right brain),
- More sympathetic: emotional intelligence (lower right brain).
- More organized & punctual (lower left brain).

Brain Dominance & Performance Effectiveness

- For more effectiveness in education both abilities should be encouraged and balanced.

- Faculty and students, for example, should be trained how to use and integrate these abilities for the "Whole-Brain" thinking, and creative problem solving.

* *Discussion: Does our educational system encourage the left or the right brain approach?*

Brain Dominance & Performance Effectiveness

- Remember **that the brain is divided to the right and left hemispheres.**

- **These two structures contain 80% of the brain.**

- **The primary mental processes in these hemispheres include:**

Vision, hearing, body sensation, intentional motor control, reasoning, conscious thinking and decision making, language and nonverbal visualization, imagination and idea synthesis.

How the "Four-Quadrant Model" relates to the physical brain?

- Herrmann noted that:

Thinking preferences seemed to fall into 4 clusters, not 2 clusters.

- In assessing over half a million people, Hermann has found that:

**** 7% have a single dominance.***

**** 60% have a double dominance.***

**** 30% have a triple dominance.***

**** 3% have a quadruple dominance.***

The Quadrant A thinking

1- Characteristics:

Factual, analytical, logical, critical.

2- Preferred subjects:

Arithmetic, algebra, calculus, sciences & technology.

3- Careers:

Engineers, computer scientists, bankers.

4- Culture:

Achievement oriented, performance driven.

Exercises to develop quadrant A thinking

- Collect data and information about a particular subject or problem.
- Organize the collected information logically into categories.
- Develop graphs, flowcharts, and outlines from data and information.
- Take a broken small appliance apart: find out about the function of each part.
- Play chess, do logic puzzles or games.

Continue

- Learn how to use an analytical software package or program on your computer.
- Exercise:
- Play “devil’s advocate” in a decision process about a problem.
- What did we learn from this exercise?

The Quadrant B thinking

1- Characteristics:

Organized, structured, sequential, planned, Detailed.

2- Subjects preferred:

Law, management, Military.

3- Careers:

Bureaucrats, administrators, planners, bookkeepers, Military Jobs.

4- Culture:

Traditional, production oriented, bureaucratic, reliable.

Exercises to develop quadrant B thinking

- Learn a new habit through planning and self-discipline.
- Plan a project by writing down each step in detail; then do it.
- Assemble a model kit by instruction.

Continue

- Exercise & Homework:
- Set up a filing system for your activities (A week activity/plan).
- Organize your desk or clothes closet.
- **Be** exactly on time all day.
- Learn time management skills.
- Homework:
- Develop a personal budget, then keep it for a week or a month.

The Quadrant C thinking

1- Characteristics:

Sensory, emotional, people-oriented.

2- Subjects preferred:

Social Sciences, music, drama.

3- Careers:

Teachers, nurses, social workers.

4- Culture:

Humanistic, cooperative, spiritual, value-oriented, feeling-oriented.

Exercises to develop quadrant C thinking

- Get together with a friend; share your feelings about a topic or issue.
- In conversation, spend most of the time listening to the other person.
- Play with a small child the way he or she wants to play.

Continue

- Become a volunteer in an activity.
- Explore your spirituality. Read about faith and religion.
- Enjoy a walk in nature.
- Create a mood in your room.
- Make time for family meals and celebrations.
- Practice artistic activities
- Exercise:
- Think about what other people (parents) have done for you and find ways to thank them.

The Quadrant D thinking

1- Characteristics:

Visual, holistic, innovative, creative.

2- Subjects preferred:

Arts, geometry, design, poetry & architecture.

3- Careers:

Artists, entrepreneur, researchers.

4- Culture:

Explorative, inventive, entrepreneurial, future-oriented.

Continue

Exercises to develop quadrant D thinking

- Look at the big picture, not the details, of a problem or issue.
- Exercise:
- Make a study of a trend, and prepare at least three scenarios.
- Exercise:
- Ask what-if question about an issue, and come up with many different answers.
- Allow yourself to daydream.
- Make sketches to help you memorize material that you are learning.

Continue

- When solving problems, find two or three different ways to do them.
- Solve problems that require brain storming; find at least ten possible answers.
- Learn to paint, draw and sketch.
- Exercise: Design a plane, for example, and fly it.
- Take as many as photos of a seen, try unusual shots.
- Imagine yourself in 2030/2050/2070.
- Homework: Create a logo for your your future own company/school.

Simple Model

Exercise

- Put your own images on the Quadrant Thinking Brain Model.

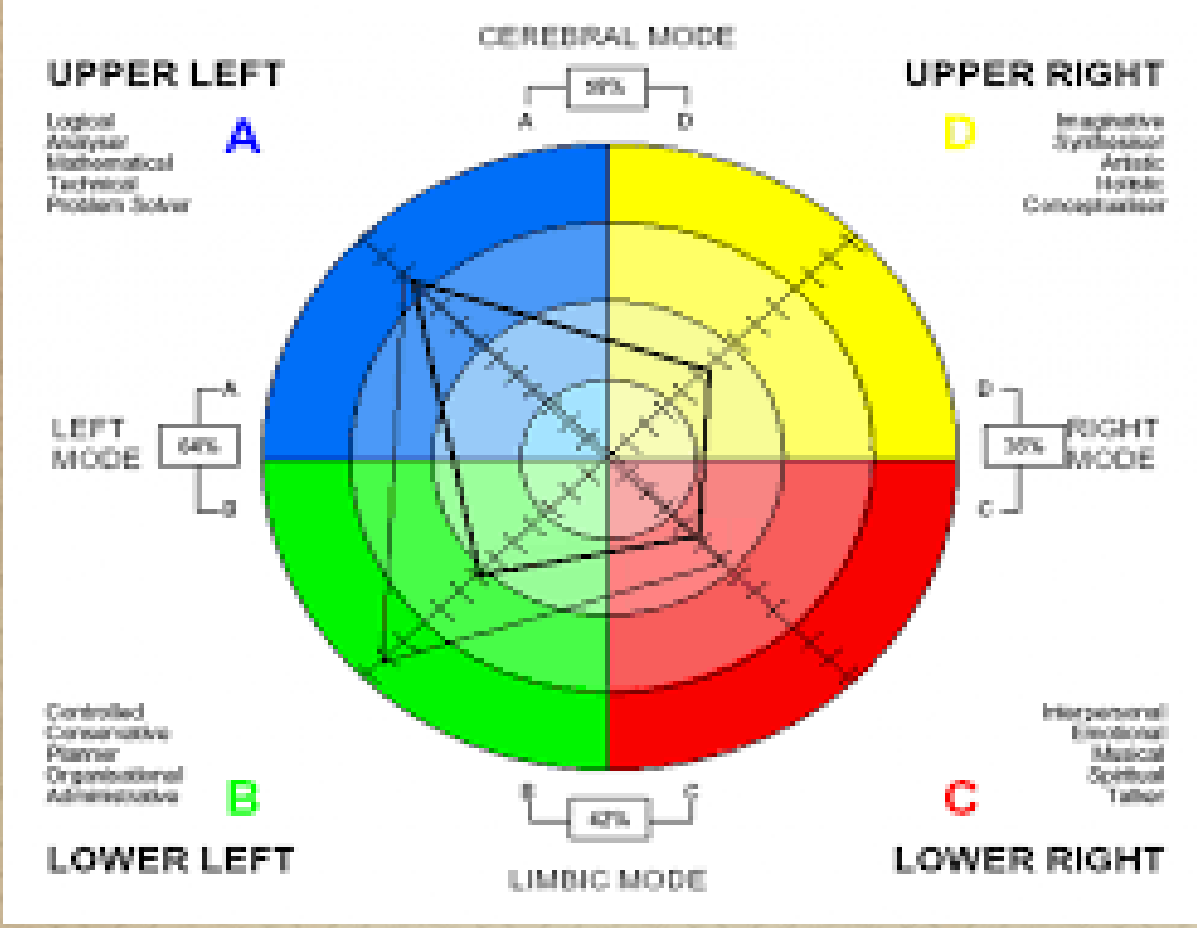
Hermann’s Brain Dominance Instrument (HBDI)

- A **system to measure and describe thinking preferences in people**, developed by William "Ned" Herrmann while leading management education at General Electric's Crotonville facility (USA).

Continue

- The HBDI® Test is a powerful psychometric assessment that defines and describes the degree to which we **Think** in the four quadrants of the Whole Brain® Model.
- HBDI Tests indicate the way we **Think** by understanding how you and your team members think means you can make decisions, solve problems, communicate work with and manage others far more effectively.

Example


CEREBRAL MODE
UPPER LEFT
UPPER RIGHT
A
D
LEFT MODE
RIGHT MODE
B
C
LOWER LEFT
LOWER RIGHT
LIMBIC MODE

HBID in Companies

The world's largest organizations trust Herrmann Model.

More than 2 million people from 97% of Fortune 100 companies have used Whole Brain® Thinking to improve productivity, innovation, collaboration, and inclusion.

Coca-Cola

Fidelity INVESTMENTS

NASA

Stanford University

IHG InterContinental Hotels Group

Microsoft

VANDERBILT UNIVERSITY

Nestle

BLACKROCK

Organizational Implications

1- It was found that people are more effective when their activities match their thinking preferences.

-Brain preference is not equal competence.

2- Competency is achieved through: Motivating, Training & Practicing.

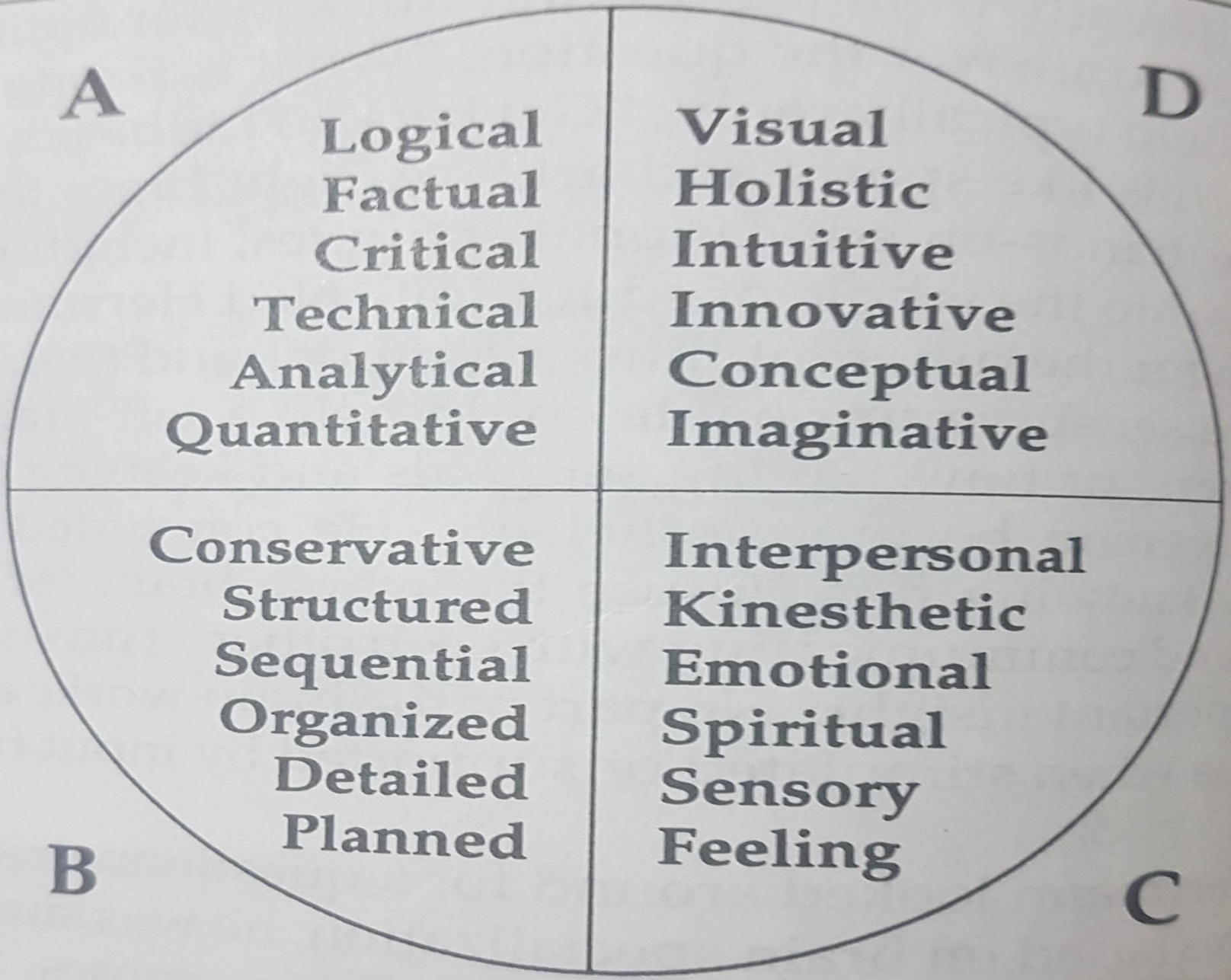
3- Many organizations/Universities tend to be entrenched in quadrant B thinking: Bureaucratic & conservative systems ?!

Discussion

What do you think about our universities?

Exercises

- What is your mindset?
- Draw a map of your thinking quadrants from the strongest quadrant to the less strong (put numbers in sequence).
- What are your most dominant quadrants?



Critical Thinking and Creativity

1- Creativity is mainly in quadrant D.

2- Critical Thinking is mainly in quadrant A.

3- Both Critical Thinking and Creativity should be developed.

4- The Goal of this course is to develop the whole brain thinking and problem solving.

The whole Brain = A + B + C + D

How to develop creative problem solving?

- **What is a Problem?**
- **How do you solve a problem creatively?**

Continue

- **A problem is not only something that is not working right or well.**
- **A problem is anything that could be made different or better through some change or development.**
- **A problem has two aspects:**
- **a) It can involve a difficulty or (danger).**
- **b) It can represent an opportunity or a (challenge) even when there is a danger (when it is over).**

Continue

- **Mathematics courses for example, provide some training in analytical thinking.**
- **It is estimated that 80% of problems in life need to be approached, and solved with creative thinking.**
- **Most students are not trained in developing critical thinking & creative problem solving .**
- **Creative thinking is not taught in our schools and universities.**

Continue

- **Looking to a complex problem from different angles.**
- **Looking to a problem from different mindsets (Whole Brain) .**

Teams & Problem Solving

- **Organizations use teams for creative problem solving.**

- **Diversity = different mindsets + males + females +++…**

What is creative problem solving?

- - Creative problem solving involves three types of thinking:
- a) Analytical thinking.
- b) Critical thinking.
- C) Creative thinking.

What is Creative Thinking?

- **CT is the ability to generate new ideas.**

- **CT is playing with imagination and different possibilities, then making new and meaningful connections while interacting with ideas, people, and environment (physical and social environments).**

Steps of Creative Problem Solving

- **CPS is a sequence of successive phases of divergent thinking, followed by convergent thinking.**

- **Use the whole brain concept in order to use both divergent and convergent thinking.**

Divergent Thinking

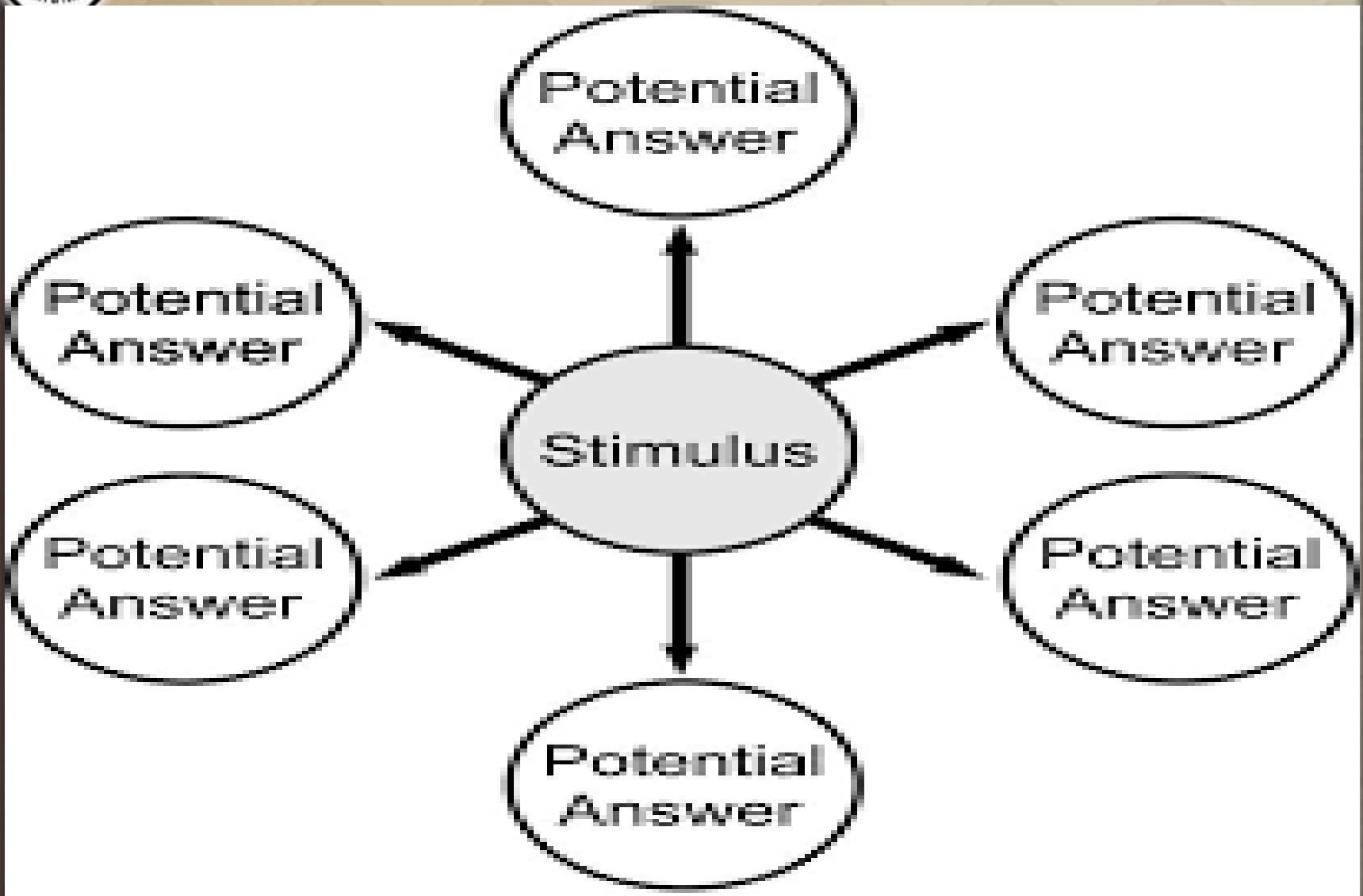
- Divergent thinking is a thought process or method used to generate creative ideas by exploring many possible solutions.

- It typically occurs in a spontaneous, free-flowing, "non-linear" manner, such that many ideas are generated.
- Look for totally new ideas/solutions.

Continue

- Examples:
- Open ended questions.
- Brainstorming technique.

What is divergent thinking?



DIVERGENT THINKING

Exercises

- 1 + 1 = 11, 3, train rail, etc….
- 4 + 4 = 8, 12 etc……
- Written exercises:
- How many ways you can use a fork?
- If you are in a foreign country without money, what to do to survive?

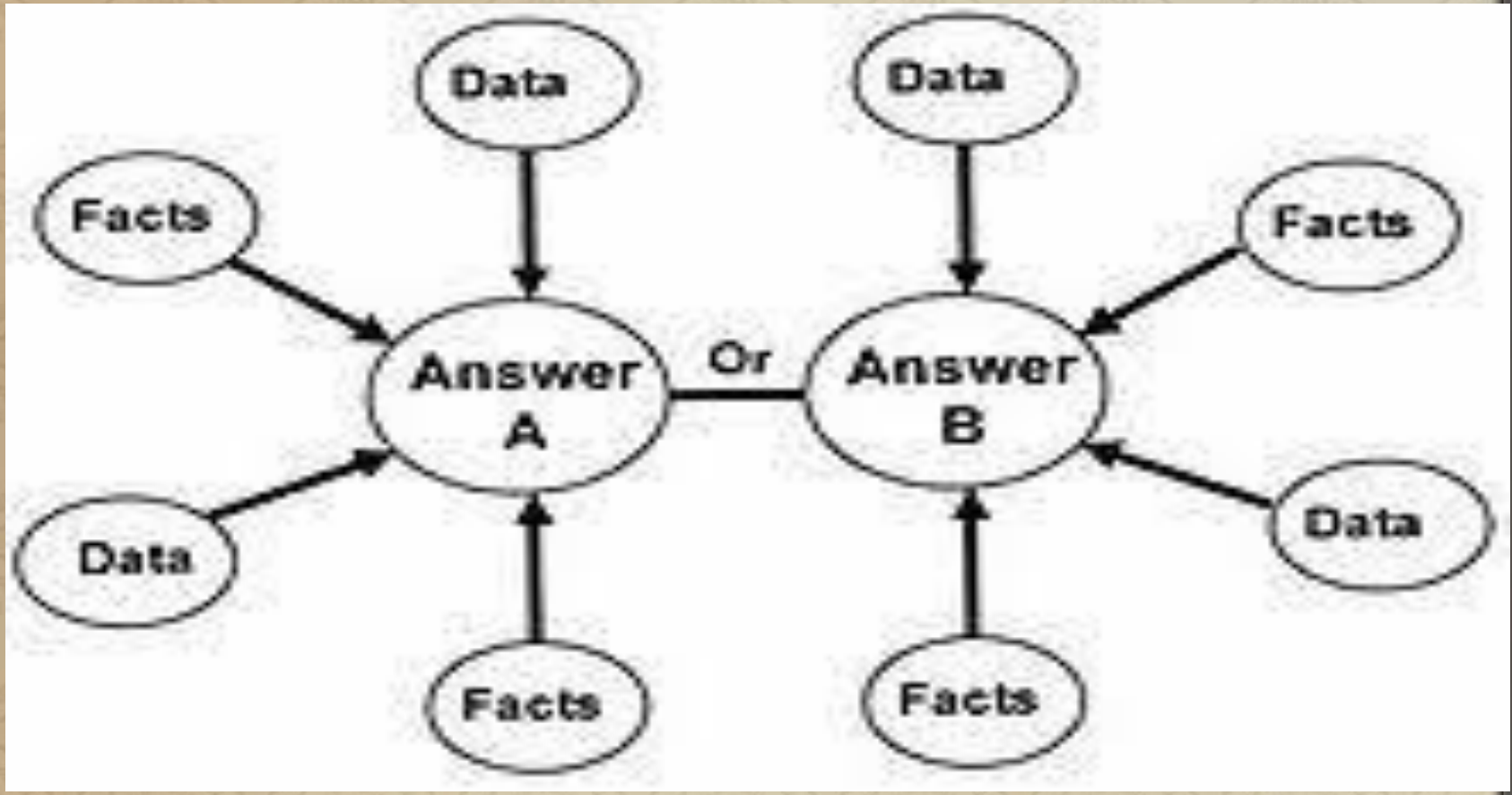
(Generate at least five solutions).

What is Convergent Thinking?

- Convergent thinking occurs when the solution to a problem can be deduced by applying established rules and logical reasoning.

- This type of reasoning involves solving a problem within the context of known information, data, facts, and narrowing down the solution based on logical inference.

Convergent Thinking



Examples

- Multiple choice exams (one write answer).
- Classical mathematical solutions.
- 5 + 5 = 10

- **Divergent and Convergent thinking are used in steps with different mindsets:**

a) **The explorer and detective for problem definition;**

b) **The artist for idea generation;**

c) **The engineer for creative idea evaluation, and synthesis;**

d) **The judge for idea judgement and decision making;**

e) **The producer for putting the best solutions into action.**

The Creative Process

- The Whole Brain Creativity and Innovation model shows how specialized thinking modes are allocated to the four quadrants.

- The creative process consists of six phases: interest, preparation, incubation, illumination, verification and application.
- Each step of this process has its own characteristic brain waves.

Continue

- From a left brain/right brain perspective, the creative process can be diagnosed as follows:
- Interest (left and right), preparation (left), incubation (right), illumination (right), verification (left) application (left and right).

- It is a balanced process--four "lefts" and four "rights."

What is Critical Thinking?

- Critical thinking refers to evaluating information, and then making a decision based on the fact & findings.
- Critical Thinking is mainly in the left brain (using logic).
- Critical thinking is what helps employees/students make decisions that solve problems based on logic and evidence.

Critical Thinking

- Critical thinking is asking for evidence (s).
- Selecting the best evidence(s).
- Example: **Myth About using 10% or less of our brain !!**
- **Read: the Brain: 10 percent and Counting. Eric Chudler, Ph.D.**
- The number of neurons in our brain is another debatable issue. 100 or 86 Billions: more or less ?
- What is important: the number or using?

Critical Thinking Skills

- 1- Analytical skill
- 2- Induction skill
- 3- Deduction skill
- 4- Inference skill
- 5- Evaluation skill

What are the Analytical Skills?

- **The ability to collect and analyse information, solve problems, and make a decision(s).**

- Analytical skills are soft skills that help you identify and solve complex problems.

- Some popular analytical skills include: critical thinking, data analysis, research and communication.

Analytical Thinking

- Analytical thinking involves the process of gathering relevant information and identifying key issues related to this information.
- This type of thinking also requires you to compare sets of data from different sources; identify possible cause and effect patterns, and draw appropriate conclusions from these datasets in order to arrive at appropriate solution(s).

The Process of the Analytical skill

1. Identifying a topic, problem or issue
2. Gathering information through testing and observation.
3. Developing solutions or deepening your understanding of the topic
4. Testing solutions or new ideas based on what you've learned.
5. Post-analysis, or reviewing what solutions worked, to assess and apply your new knowledge.

How to improve your Analytical Skills?

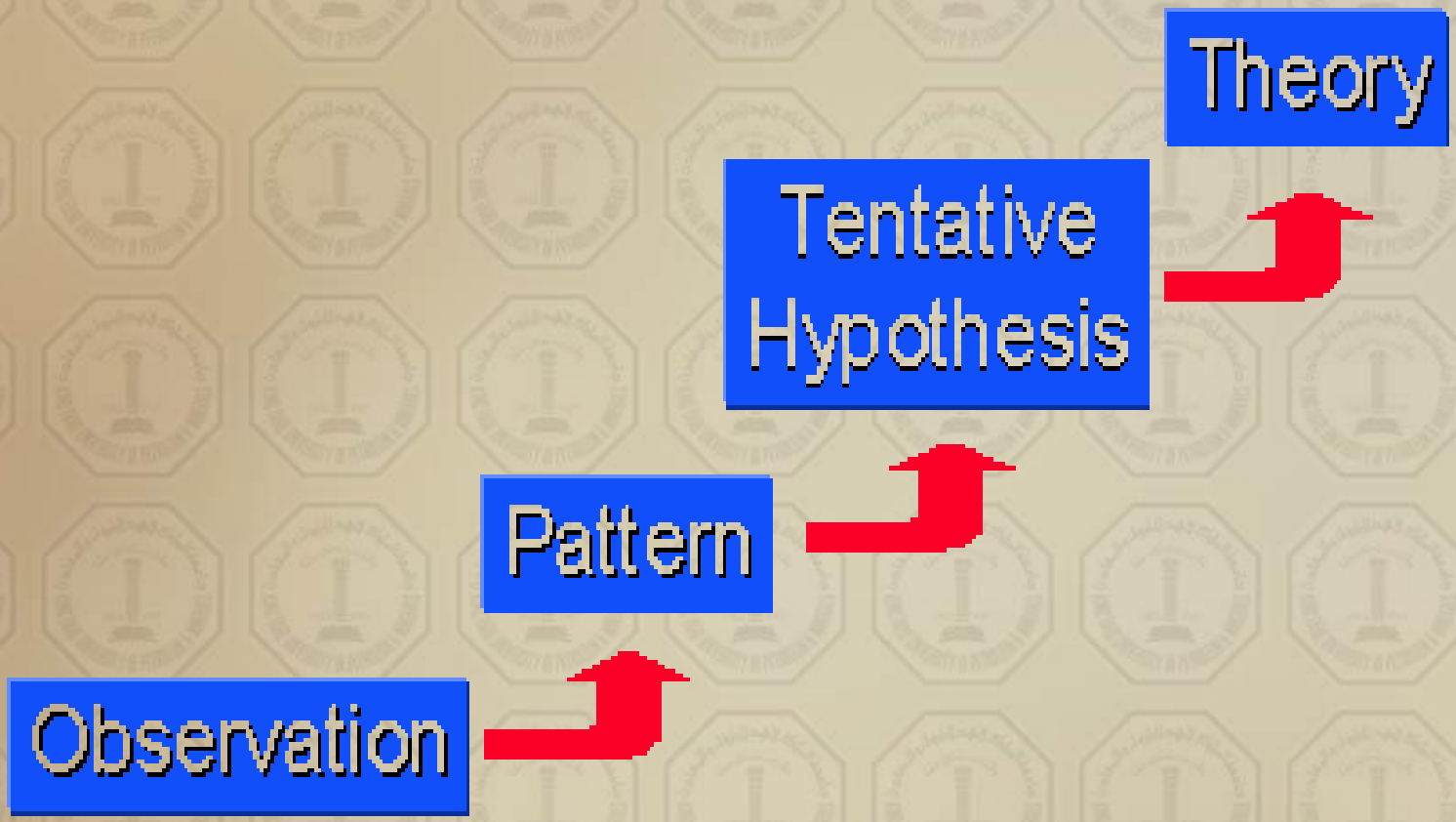
- Practice key analytical skills in your current role.
- Take classes that emphasize the use of analytical skills.
- Participate in activities that require the use of analytical skills such as team sports, games or reading.
- Seek advice or mentorship from professionals in your field or desired industry.
- Conduct research on best practices for your industry.
- Improve your subject-matter knowledge, which is essential to faster problem-solving.
- Take on leadership roles that require the use of critical analytical skills

Analytical Thinking Skills

Inductive Reasoning Skill

- Beginning with specific observations and measures,
- Detect patterns and regularities,
- Formulate some tentative hypotheses that we can explore,
- Finally end up developing some general conclusions or theories.

Inductive Reasoning Skill



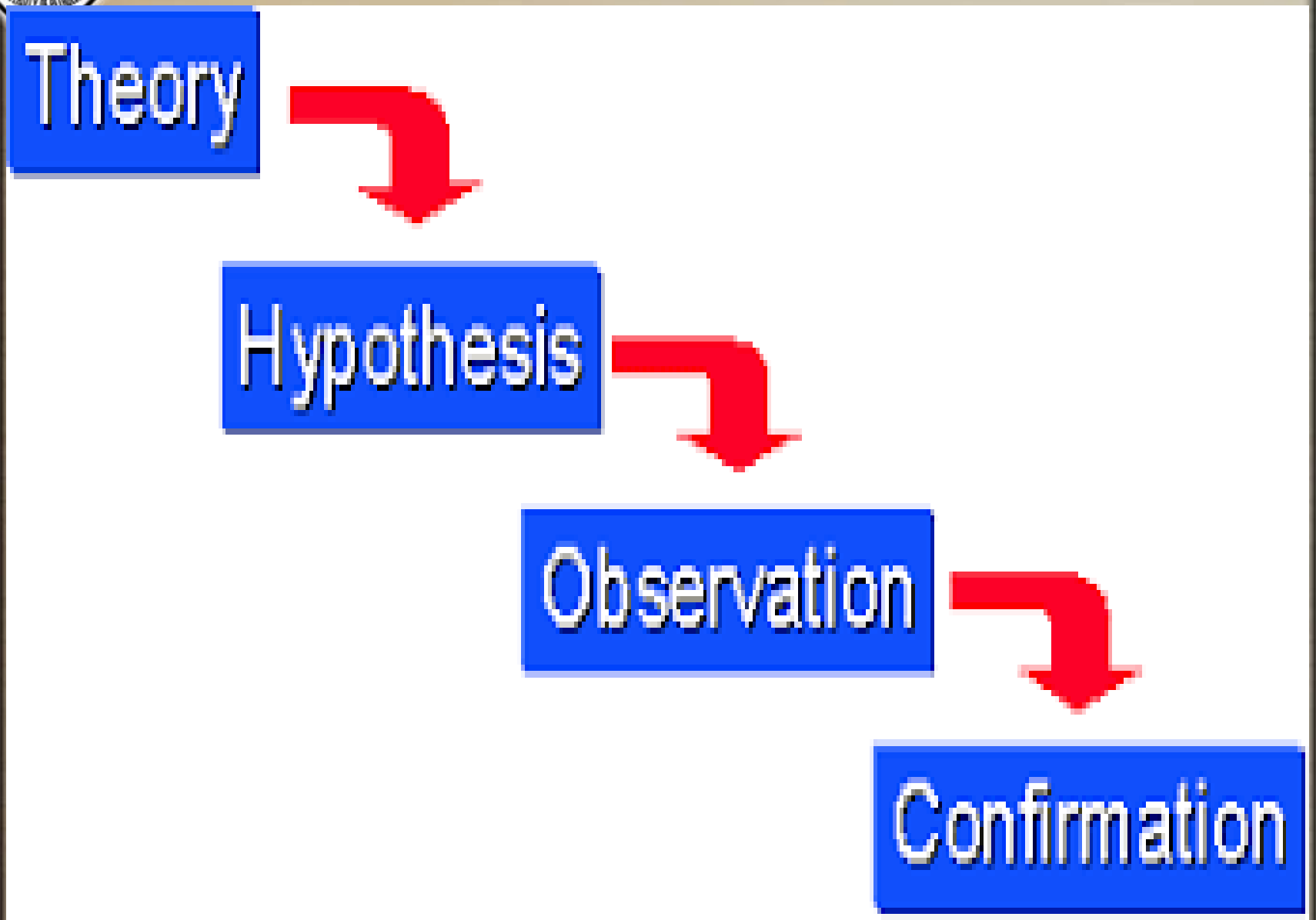
How to improve your inductive skills?

- Ask the students and discuss.

Deductive Reasoning Skill

- It starts from the more general to the more specific.
- We might begin with thinking up a *theory* about our topic of interest.
- We then narrow that down into more specific *hypotheses* that we can test.
- We narrow down even further when we collect *observations* to address the hypotheses.
- This leads us to be able to test the hypotheses with specific data – a *confirmation* (or not) of our original theories.

Deductive Reasoning Skill



How to improve your deductive skills?

- Ask the students and discuss.

Inference Skill

- Inference: A conclusion made based on observation/evidence and reasoning.

  Evidence + Reasoning = Inference.

We use reason/logic to form inferences:

conclusions drawn from assumptions that are supposed to be true.

What is the Inference Skill?

- An inference is the process of reasoning from what we think is true to what else is true.

- Example:
- If there were 5 chairs originally in room A, and only three used in this room, and the two remaining chairs were put into room B, then we know that there are two chairs in room B.

Inference

- The assumption is that room B was empty.
- Logic is not always equal to truth.

How to improve your inference skill?

- Homework

What is the Evaluation Skill?

- To evaluate, or ‘critically’ evaluate is to reach a conclusion, through a process of critical thinking, about the value, or ‘soundness’ of an argument.
- Critical analysis is a key activity in evaluation.
- Evaluation is about weighing up the strengths and weaknesses of an argument in order to decide its value.
- Acceptable or not acceptable !

How to improve critical thinking?

- According to Brian Oshiro (educator and teacher trainer), CC might be developed by the following steps:

1. **Go beyond "what?" — and ask "how?" and "why?"**

2. Follow it up with asking "How do you know this?"

continue

3. Prompt the students to think about how their perspective may differ from other people's perspective.

4. Finally, ask the students how to solve a problem critically and creatively.

Make sure referring to: "Creative problem solving".

Brain Storming Technique

- State the problem.
- Generate as many solutions as possible.
- Wild/strange ideas are encouraged (Divergent thinking).
- No criticism is allowed.
- No one best solution/no laughing !!
- Judgement/evaluation is deferred until later.
- Chose the best answer/answers/solutions.
- Implement the best answer(s)/solution(s).

Brain Storming Methods

- There are many brain storming methods:
- Verbal Brain Storming: The artist Mindset.
- Written Brain Storming
- Delphi technique

Brain Storming

- Exercise:

- In small groups formulate a real problem, and try to find as much as solutions to it.

Barriers to Critical Thinking

- 1. Egocentric Thinking
- 2. Groupthink
- 3. Drone Mentality
- 4. Social Conditioning
- 5. Biased Experiences
- 6. Schedule Pressures
- 7. Arrogance and Intolerance
- 8. **Using Emotions Instead of Logic**

Egocentric Thinking

- **Egocentric thinking** refers to an inability of a person to see a situation or event from another person's point of view.
- Example: In groups' discussions, people tend to exaggerate their own importance. Each person sees themselves as having more impact on the opinions of others than is the case.

Drone Mentality

- A pattern of not paying attention to the world, people or surroundings.
- Symptoms include:
- • Working through daily tasks without thinking,
- Shying away from new challenges or problems. Without a conscious effort it is easy to loose critical thinking skills.

Social Conditioning

- **The sociological process of training individuals in a society to act or respond in a manner** generally approved by the society in general and peer groups . (A la Mode) !

- Example: The behaviors of children, as they imitate family members, friends, famous figures and even television characters.

Biased Experiences

- **Experience bias** may occur when we forget that our truth is not always the only option. It might happened during a time of instant and constant collaboration, ...
- It hinders objective solutions or decisions.

Schedule Pressures

- It refers to the shortness of working time that was originally allocated to a schedule to perform some work.

- It signifies a situation when assigned employees have to perform the same amount of work over a shortened period of time caused by time pressure.
- We have to finish it now or today !!

Arrogance and Intolerance

Using Emotions Instead of Logic

- I like you but I fail you in the exam !!
- The story of my student…

Continue

- **9. Fear of Failure or Change**
- **10. Assumptions without evidence**
- **11. Not Knowing What's Fact and Opinion**
- **12. Popularity fallacy**

How to overcome critical thinking barriers?

- Homework?
- Provide examples from you culture and environment for critical thinking barriers, and how to solve them.

Overcoming Mental Barriers to Creative Thinking

Mental Blocks

- **False assumptions:**

  a) "An intelligent mind is a good thinker".

  b) "Play is frivolous" (No serious value).

☹ **c) "Creativity cannot be taught or**
☹ **learned".**

- **d) Humor: Humor reduces tension, stress and monotony.**

How to Cure False Assumptions?

- **Get facts.**

Use quadrant A thinking: Critical & Analytical.

Learn to play with ideas.

- **Practice quadrant D thinking.**
  - What-if by playing with possibilities.
  - What if by using computer.
- **Implement creativity and Whole-Brain thinking into your life.**

Mental Blocks to Creative Thinking

- *Habits: Example*

- *Mental block 1:* **There is only one right answer to a question.**
- **Example: 4 + 4 = ?**
- *Mental block 2:* **Looking at a problem in isolation.**

Attitudes/Emotions/Feelings

- ✓ **Attitudes and emotions can be serious barriers to creative thinking because they are difficult to deal with and to change.**
- ✓ **Negative attitudes are obstacle to creativity.**
- ✓ **Negative emotions may hinder creativity.**
- ✓ **Negative feelings may become obstacles.**
- ✓ **Solution: Improvements in quadrant C thinking are required.**

Other Blocks

- **Mental block 1: *"Negative thinking".***
- Mental block 2: *"Risk avoidance or fear of failure".*

Continue

- **Mental block 3:** ***"Discomfort with ambiguity".***

- ***Culture & Uncertainty avoidance***

Other blocks

- Stress: Burn out
- Cultural barriers: religion, language, traditions….
- Proverbs: Mental short cut.
- Fanatic beliefs.