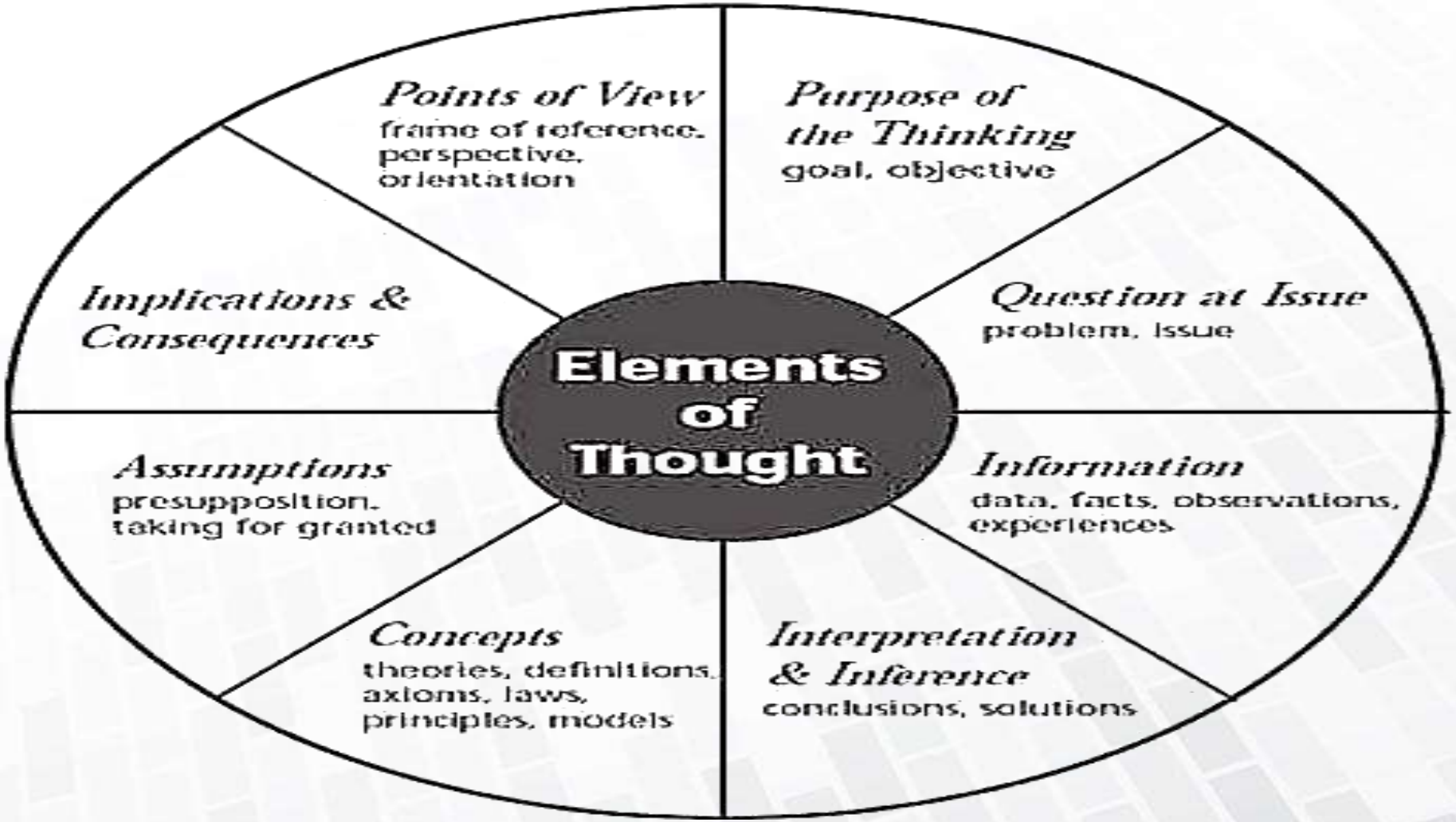
SMART
TRAINING RESOURCES INDIA PVT LTD
The Single Largest Employability Enhancer In India

Introduction to Critical Thinking

Famous Quote

"The function of education is to teach one to think intensively and to think critically. Intelligence plus character - that is the goal of true education" -Martin Luther King, Jr.
"Education is not the learning of facts, but the training of the mind to think." -Albert Einstein
"Five percent of the people think; ten percent of the people think they think; and the other eighty-five percent would rather die than think." — Thomas A. Edison

The Elements of Thought



What is Critical Thinking?

Write your understanding of critical thinking?

What is critical thinking?

- Critical thinking is the ability to think clearly and rationally about what to do or what to believe.

What is not critical thinking?

- Mere criticize everything
- Thinking a lot

- **Productive:** Thinking that goes beyond observing and recalling facts
- **Critical:** Being able to ask questions and gather information
- **Weighing & Solving:** When you think critically you weigh evidence, solve problems and make decisions
- **Creating & Applying:** When you think critically you create new ideas, and turn information into a tool by applying what you have learned in previous situations to new situations

Stop and Think

Can you think of a time when you had a critical thinking response to a situation?
What did you do?

Example: You had to get a B on a paper to pass a course but you got a C-.

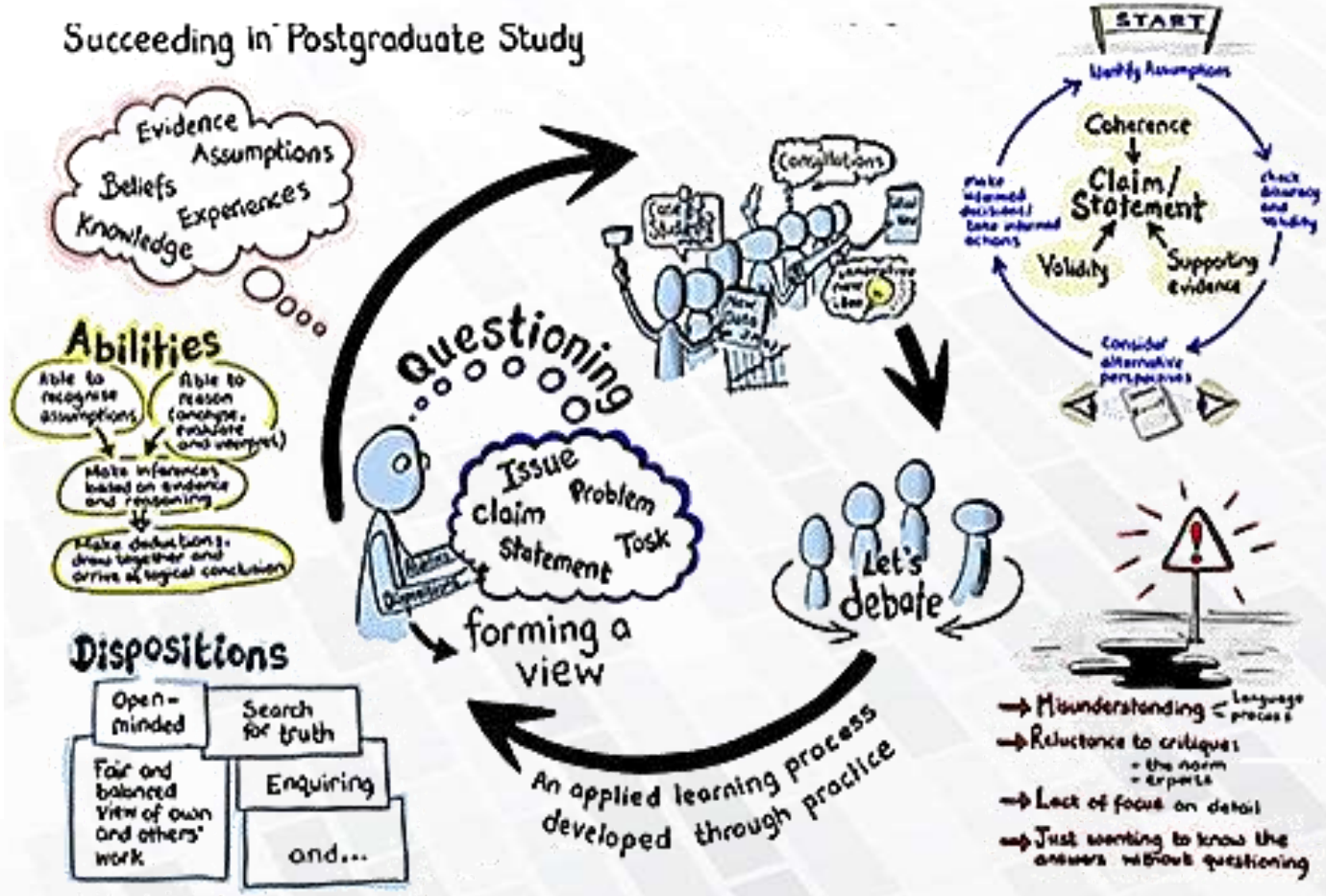
- **A non-critical thinking response** would be to say that you did not pass the course.
- **A critical thinking response** would identify potential solutions like asking the instructor if you can redo the paper, asking if you can do another assignment to add another grade to your average, or retaking the course.

Think about the example.
One way, the case is closed.
The other way, options are revealed and explored, possibilities open up and you can take action to improve the situation.

Can you think of a time when you had a non-critical thinking response to a situation? What could you have done differently?

Stop and Think

How can you incorporate the principles of critical thinking into your academic life?



What hinders Critical Thinking?

- Lack of awareness/practice of rational (logical) thinking
  - Those ignorant of how to think critically
- Personal biasness
  - Some people deliberately avoid critical thinking on situations where out come may put him in unfavorable situation
- Inherited opinion/Cultural biasness
  - Most of the people die with the opinions they inherit from parents and close ones
- Intellectual arrogance
  - Arrogance due to one's education level or qualifications refusing to think critically in open situations
- Intellectual laziness
  - Just lazy to think critically
- Black & white thinking
  - Those who think in one of the extremes without considering all the intermediate possibilities

"Standards" Typically Used in Thinking

"It's *true* because **I** believe it" (innate egocentrism)

"It's *true* because **we** believe it" (innate sociocentrism)

"It's *true* because **I want** to believe it" (innate wish fulfillment)

"It's *true* because I **have always believed it**."
(innate self-validation)

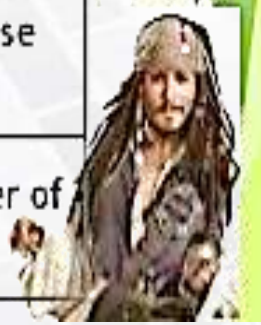
"It's *true* because it is **in my selfish interest** to believe it."
(innate selfishness)

Barriers to Critical Thinking

5 most powerful barriers to critical thinking.

Egocentrism	Self centered thinking ❑ Self interest thinking ❑ Thinking self as centre of attention
Sociocentrism	Group centered thinking ❑ Group interest thinking ❑ To assume that own group is more superior or righteous.
Unwarranted Assumptions	A belief that something is true without proper evidence or justification.
Wishful Thinking	Believing something is true because one wishes it to be true.
Relativism	Thinking that truth is just a matter of opinion.

The problem is not the problem. The problem is your attitude towards the problem.



I am probably the greatest thinker since Socrates!

Characteristics of Critical Thinker

Are you ***OPEN MINDED*** about other people's view?

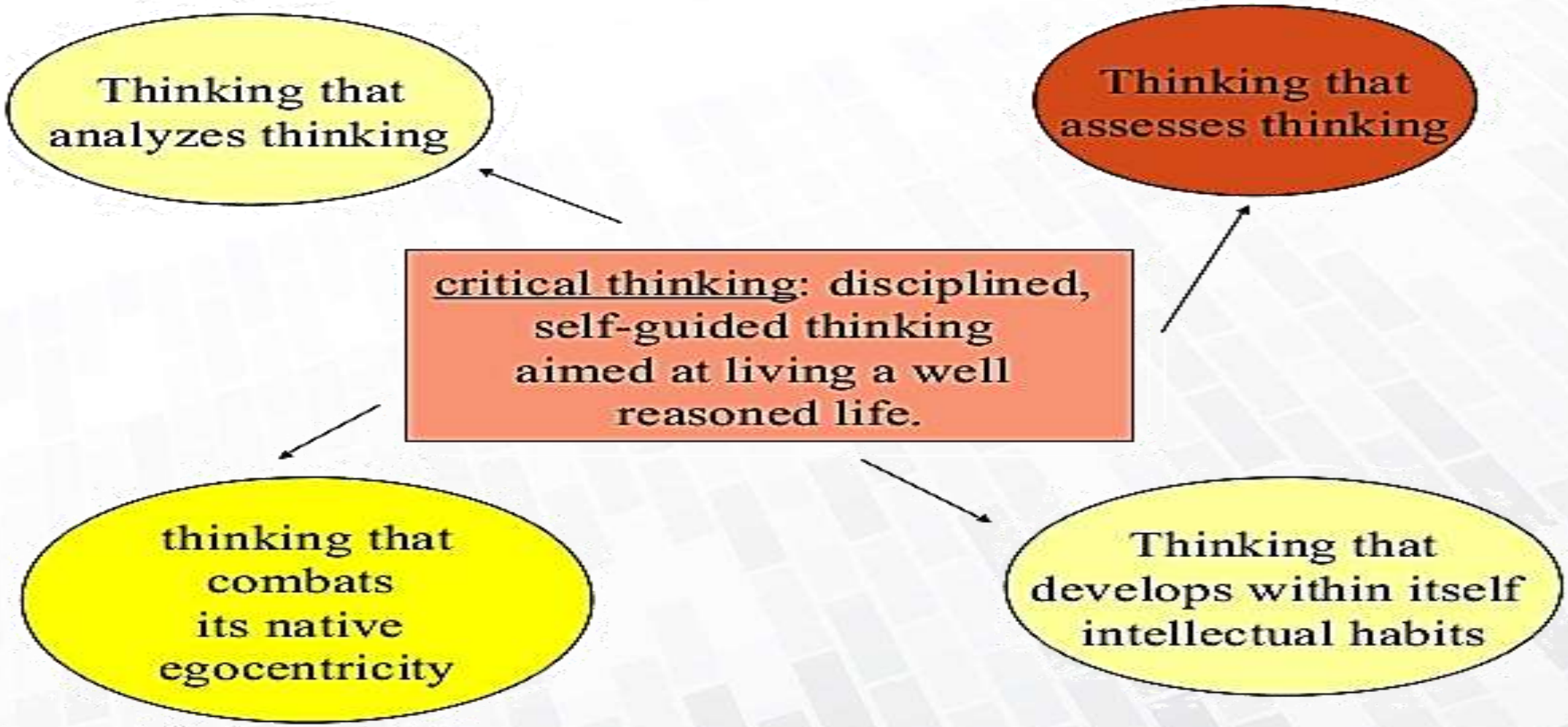
Are you ***HONEST*** to yourself (or others) when you are wrong?

Do you have the **COURAGE** *and* ***PASSION*** to take initiative and confront problems and meet challenges?

Are you **AWARE** of your own biases and preconceptions?

Do you **WELCOME CRITICISM** from other people?

Do you have **INDEPENDENT** opinions and are not afraid to disagree?


Thinking that analyzes thinking
Thinking that assesses thinking
critical thinking: disciplined, self-guided thinking aimed at living a well reasoned life.
thinking that combats its native egocentricity
Thinking that develops within itself intellectual habits

Attributes of Critical Thinkers

- Asking pertinent questions
- Curiosity
- Problem solver
- Evaluates statements & arguments
- Seeks new solutions
- Actively shares new knowledge
- Willing to examine beliefs, assumptions & opinions
- Admits a lack of knowledge & understanding
- Distinguishes between facts and opinion
- Sees critical thinking as a life-long process of self-assessment
- Seeks proof
- Reflective
- Open to changing ones mind
- Seeks evidence to support assumptions and beliefs
- Accepts others beliefs and opinions
- Waits till all facts before making judgments
- Seeks clarity and exactness
- Actively enjoys learning
- Careful and active observer
- Humility

Perspectives on Critical Thinking

- Critical thinking is based on concepts and principles, not on hard and fast, or step-by-step, procedures.
- Critical thinking does not assure that one will reach either the truth or correct conclusions.
- Critical thinking is a continuous process and often doesn't lead to a final conclusion.
- Critical thinking is hard intellectual work
- Critical thinking is an intellectual skill that can (must) be learned and improved

The Critical Thinking Mind

=

The Educated Mind

Benefits of Critical Thinking

Examples:

- **Academic Performance**
  - understand the arguments and beliefs of others
  - Critically evaluating those arguments and beliefs
  - Develop and defend one's own well-supported arguments and beliefs.
- **Workplace**
  - Helps us to reflect and get a deeper understanding of our own and others' decisions
  - Encourage open-mindedness to change
  - Aid us in being more analytical in solving problems
- **Daily life**
  - Helps us to avoid making foolish personal decisions.
  - Promotes an informed and concerned citizenry capable of making good decisions on important social, political and economic issues.
  - Aids in the development of autonomous thinkers capable of examining their assumptions, dogmas, and prejudices.

How to practice critical thinking?

Do you agree with this statement?

Some people study all their life and at their death they have learnt everything except to THINK.

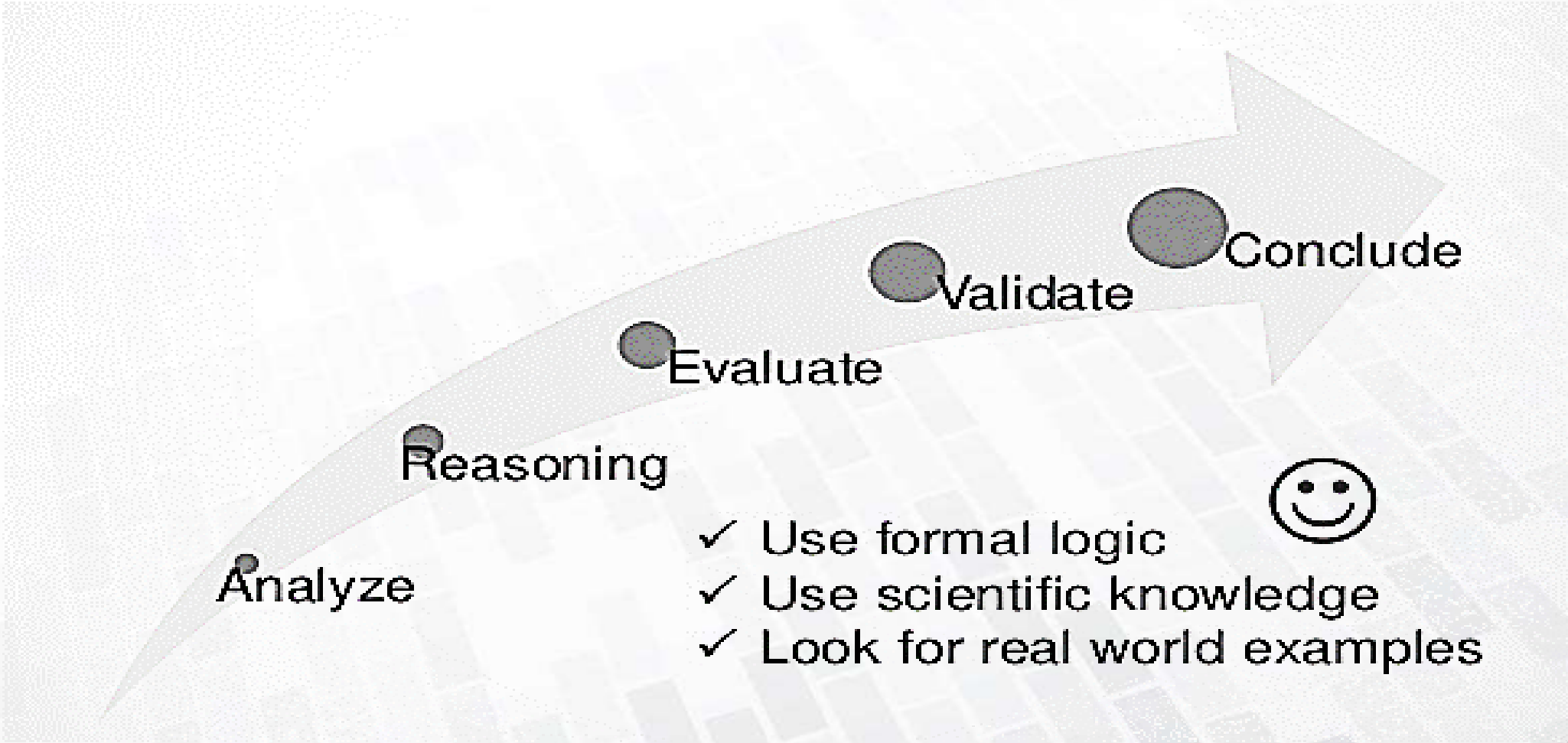
-Francoise Domergue

Asking question is the heart of critical thinking

Questioning to develop critical thinking requires students to:

- Raise issues
- Discover ideas and things
- Peruse problematic areas
- Seek clarity and relevance of ideas and
- Find evidence and make conclusions.

Critical Thinking Steps



How to do Critical Thinking

1. Do careful, intentional thinking
2. Analyze & evaluate each piece of the argument
   - Identify facts and opinions
   - Evaluate the opinions
3. Use of reason or logic to check the validity
4. Check truthfulness of each fact to see if it is a sound argument
5. Application/test with real world scenarios to verify

What does it mean to be an active learner?

- Getting involved instead of remaining disengaged in the classroom: asking questions, taking notes, thinking as you are listen, conversing with other students and the instructor about ideas.
- Taking initiative to make your own decisions instead of waiting passively to be told what to do.
- Following through on commitments and assignments instead of giving up.
- Taking responsibility for your decisions and thoughts instead of blaming others or events “beyond your control”.

Tips for Active Learner

Study with other students.

- Talking about assignments and getting other points of view will help you learn the material faster and more thoroughly.
- Thinking critically about others' opinions and thoughts helps to clarify your own.

Use your resources.

- Instructors, other students, the library, tutors, academic advisor, books, etc.
- The more people and resources you form working relationships with, the better your chance of success in reaching your goals.

- Prepare for class by reading your textbooks and reviewing notes from previous classes.
- Ask questions
- Put what you learnt into your own words. Summarize your notes and reading.

Fact vs. opinion

Fact

- A statement of fact can be proved TRUE or FALSE using standard knowledge
  - An observable or obvious thing
  - It has been proved by scientific experimentation
  - Can be deduced by formal logic
- Example
  - Earth is round
  - Smoking causes cancer
  - There is a force towards the earth

Opinion

- A statement of opinion is what someone believes or thinks
  - He must provide enough evidence to prove his opinion
    - Called burden of proof
  - We have to test if that opinion is valid or not
  - If we do not accept the opinion we must show the fault in the opinion
    - We do not have to prove that opinion is false
  - We may or may not provide alternative opinion
- Example
  - There is life after death
  - Mr. X is a better leader than Mr. Y

SMART
TRAINING RESOURCES INDIA PVT LTD
The Single Largest Employability Enhancer In India

Critical Thinking – Reasoning Techniques

Session - 2

Reasoning techniques

- Deductive Reasoning
  - Determines whether the truth of a conclusion can be determined for that rule, based solely on the truth of the premises
  - The Best approach ☺
- Inductive Reasoning
  - Attempts to support a determination of the *rule*
  - Use with care 😐
- Abductive Reasoning
  - a.k.a. inference to the best explanation, selects a cogent set of preconditions
  - Use with care 😐

Deductive Reasoning – How to come to judgements

- Derive logically necessary conclusion from given premises/ assumptions
  - Determines whether the truth of a conclusion can be determined for that rule, based solely on the truth of the premises
- Mathematical logic and philosophical logic are commonly associated with this type of reasoning.

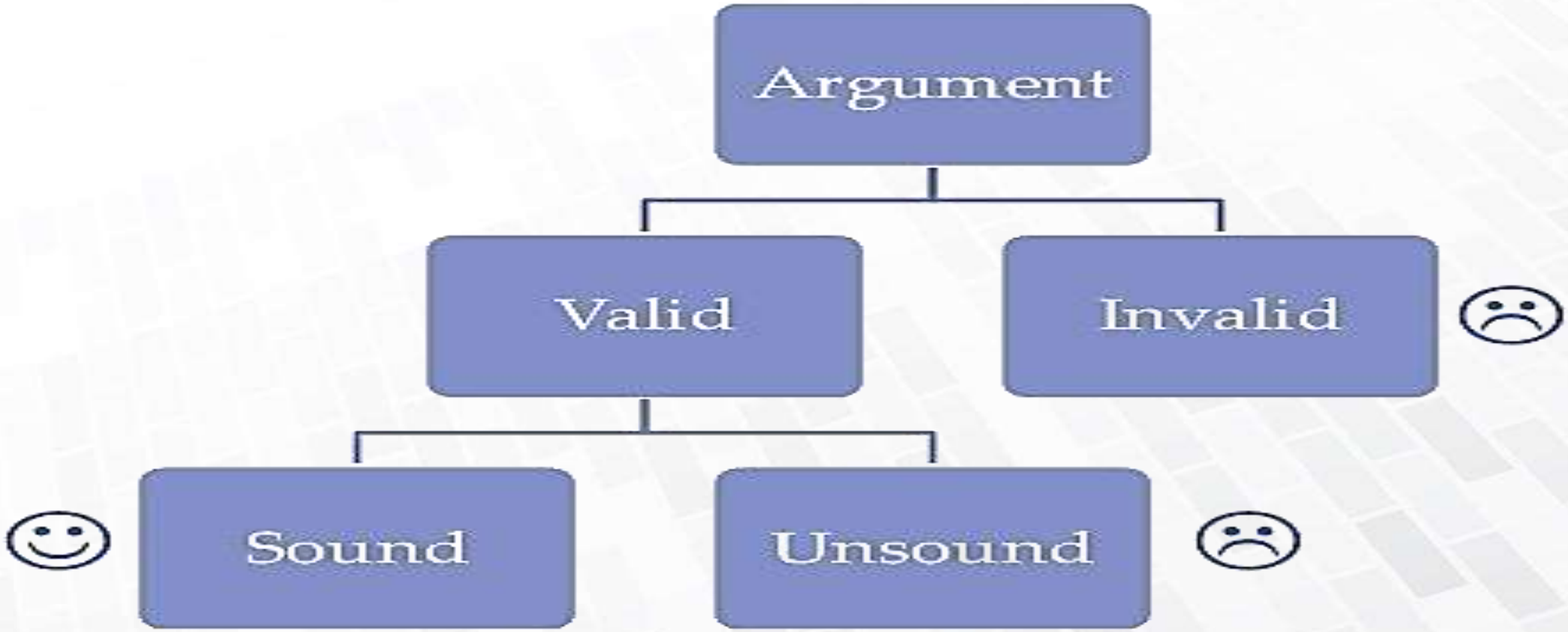
- Using formal logic
  - Example 1:
    X > 4
    y > x
    Therefore y >4
  - Example 2:
    "When it rains, things outside get wet."
    "The grass is outside."
    Therefore, when it rains, the grass gets wet.
- Using scientific knowledge
  - Example:
    Removing oxygen will extinguish fire
    Covering with blanket remove/block oxygen
    Therefore, Covering with blanket will extinguish the fire

What is an argument?

- An argument is set of assumptions/ premises followed by a conclusion
- Example:

Socrates is a philosopher. *(Assumption)*
All philosophers like thinking. *(Assumption)*
Therefore Socrates likes thinking. *(Conclusion)*

Outcome of an argument



What is a valid argument

- An argument is said to be valid if the conclusion is logically true, whenever all the assumptions/premises are true
- Example
  - Valid argument

    If there is an earthquake, the detector will send a message.
    No message has been sent.
    So there was no earthquake.
  - Invalid argument

    Whenever Anil is here, Kumar is also here.
    Anil is not here.
    So Kumar is not here.

What is valid & sound argument

- If an argument is valid and all the assumptions are found/proved to be correct, then the argument is said to be sound.
- We must accept only the sound arguments!

Example:

If husband is the president, then she is the first lady.

Barack is President of the USA.

Michelle is the wife of Barack.

=> Therefore, Michelle is First Lady.

This argument is **valid & sound**.

Valid but not sound deductive argument - example

If the moon is made of green cheese, then astronauts can eat moon rocks.

The moon is made of green cheese.

=> Therefore, astronauts can eat moon rocks.

This argument is valid but ***un*sound**.

Invalid deductive argument - example

If Abraham Lincoln died of cancer, ther Lincoln is dead today.

Lincoln is dead today.

=> Therefore, Abraham Lincoln died of cancer.

(This argument is ***in*valid**.)

Inductive reasoning

...

- Use patterns of concrete instances to arrive at a conclusion
- Attempts to support a determination of the *rule*
- It hypothesizes a *rule* after numerous examples are taken to be a *conclusion* that follows from a *precondition* in terms of such a *rule*
  - It's a way of generalization through observation and careful systematic analysis

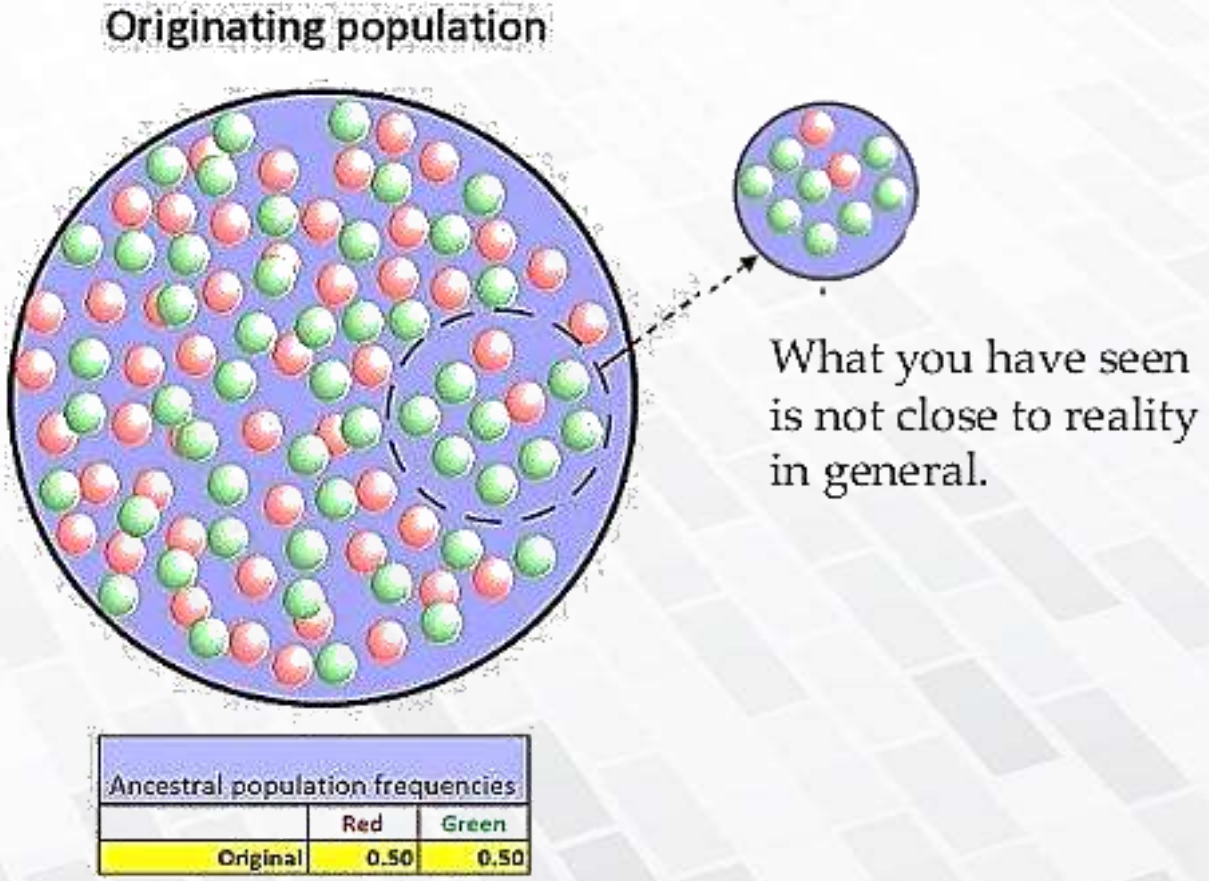
Inductive Reasoning - How to come to judgements

- By analyzing results of empirical data using concepts of statistics and probability
  - Above 50% chance: Strong Argument
  - 50% or Less chance: Weak Argument
- Is the value considerably higher than average for a sample with particular feature
- Example:

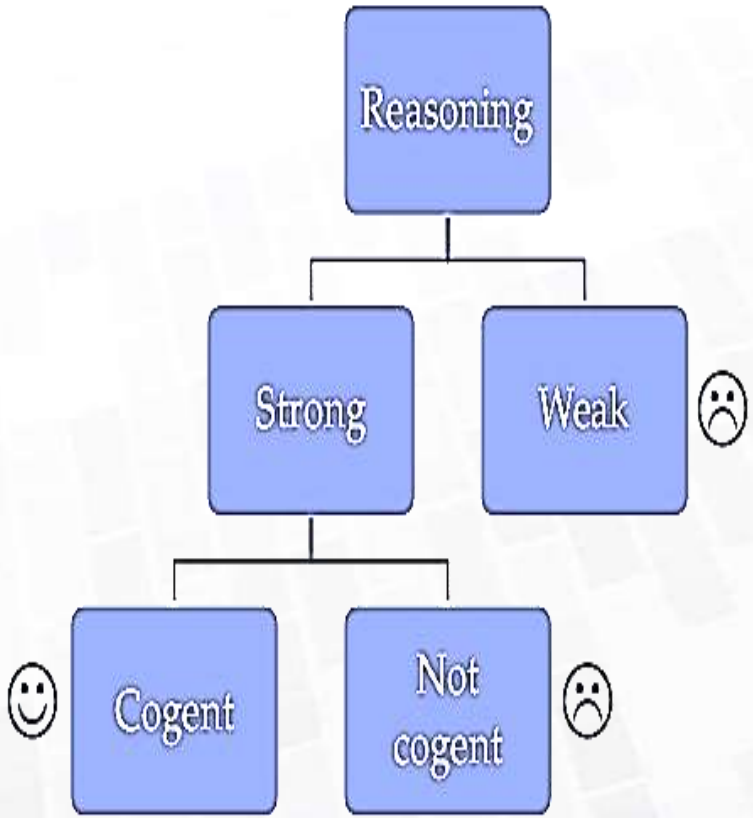
  "The grass got wet numerous times when it rained, therefore: the grass always gets wet when it rains."

Inductive Reasoning - caution

- Use of smaller sample may lead to false conclusion
- What is your visibility may be too narrow



Outcome of inductive reasoning



- Strong inductive argument
  - The truth of the premises really ***does*** prove that the conclusion is probably true
    - Cogent inductive argument ☺
      - A strong inductive argument in which *all* the premises are *actually true*
    - Not cogent inductive argument ☹
      - A strong inductive argument in which *at least one* premise is *false*.
- Weak inductive argument ☹
  - The truth of the premises really does not prove that the conclusion is probably true

Strong & cogent inductive argument - example

Most recording artists have talent.

Britney Spears is a recording artist.

=> Therefore, Britney probably has talent.

This argument is **strong and cogent**.

Strong but not cogent inductive argument - example

Most boys like to play sports.

Britney Spears is a boy.

=> Therefore, Britney probably likes to play sports.

This argument is ***strong*** but ***not cogent***.

Weak inductive argument

Britney Spears is a recording artist.

Britney has blonde hair.

=> Therefore, most recording artists have blonde hair.

This argument is **weak**.

Abductive reasoning

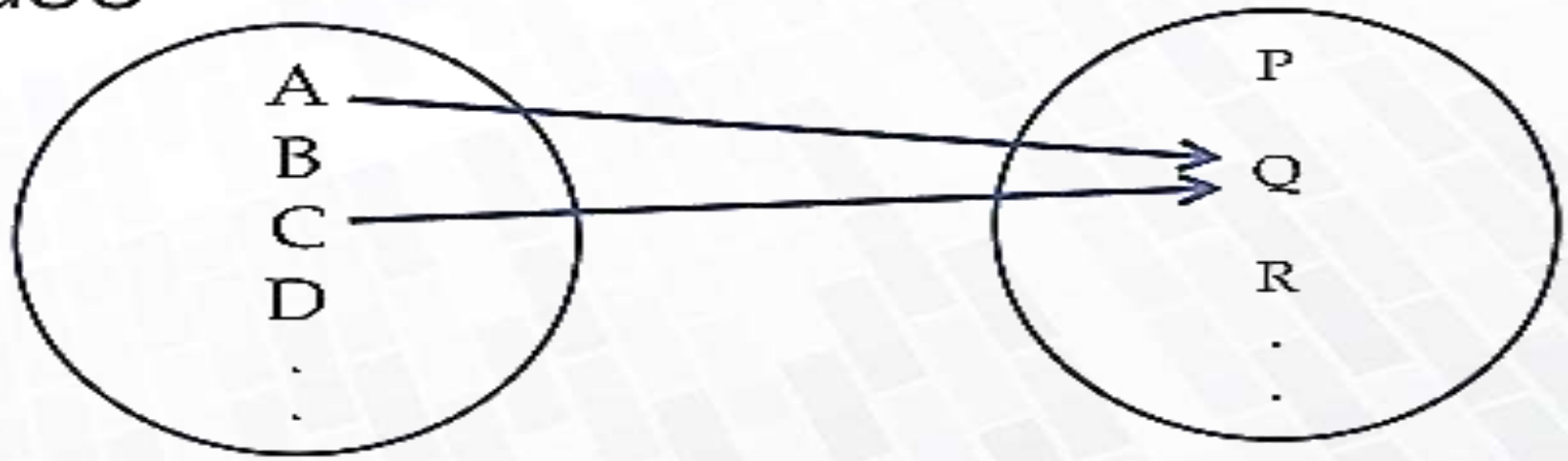
...

Incomplete observation ⇒ Best prediction (May be true)

- Abductive reasoning allows inferring a as an explanation of b
- As a result, abduction allows the precondition a to be adduced from the consequence b (i.e. effect to cause)
- Deductive reasoning and abductive reasoning thus differ in the direction in which a rule like " a entails b is used for inference.

Abductive Reasoning - caution

- Considerable risk of inferring wrong cause



- You may infer A as the cause, whereas actual cause might be C in this case

Overview of reasoning

Deductive Reasoning

General rule ⇒ Specific conclusion (Always true)

Inductive Reasoning

Specific observation ⇒ General conclusion (May be true)

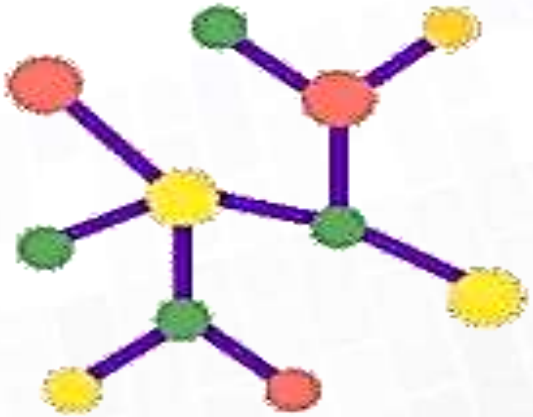
Abductive Reasoning

Incomplete observation ⇒ Best prediction (May be true)

Tools &Techniques for Critical Thinking

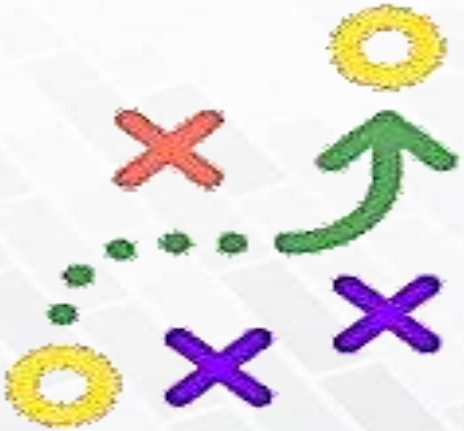
- Analysis, synthesis & application
- What, Why & How? Approach
- Abstraction
- Root cause analysis

Analysis, synthesis & application



Analysis

Synthesis



Application

What, Why & How? approach

What?

Why?

How?

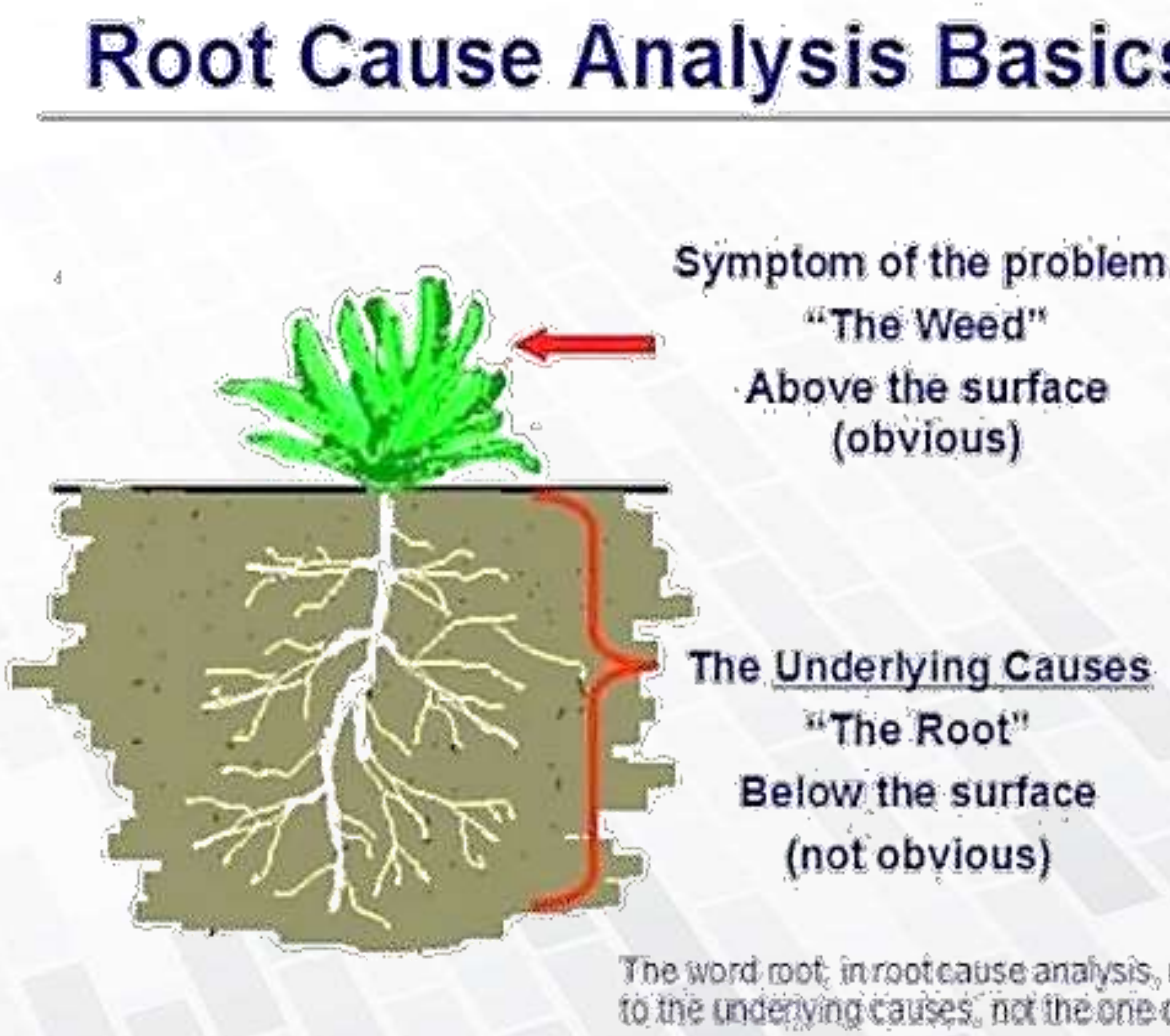
Abstraction

Abstraction - usages

- Understanding mathematics
- Design (model) before develop/ implement

Root cause analysis

- We must try to understand the root causes rather than jump into consider immediate causes in order to solve problems
- Ask why five times



Root cause - Example

The vehicle will not start. (the problem)

Why? - The battery is dead. (First why)

Why? - The alternator is not functioning. (Second why)

Why? - The alternator belt has broken. (Third why)

Why? - The alternator belt was well beyond its useful service life and not replaced. (Fourth why)

Why? - The vehicle was not maintained according to the recommended service schedule. (Fifth why, a root cause)

Quiz

- How do you put a giraffe into your refrigerator?

Open the refrigerator, put in the giraffe, and close the door.

This question tests whether you tend to do simple things in an overly complicated way.

- How do you put an elephant into your refrigerator?

Did you say, Open the refrigerator, put in the elephant, and close the refrigerator?
Wrong answer.

Correct answer: Open the refrigerator, take out the giraffe, put in the elephant and close the door.

This tests your ability to think through the repercussions of your previous action

Activity

A woman goes for a haircut at a hair-cutting salloon. The hairdresser asks her what brand of shampoo she uses. He then puts some of her hairs under a microscope and shows her that there is a white film on the hairs. He recommends that she buy the store's brand of shampoo rather than the one she has been using.

What are some good questions to ask herself about this situation?

Possible questions

- Will the same film be there with all shampoos, even the store's?
- Is the film the result of the shampoo or of something else entirely?
- Is there anything negative about having that film on my hair that can only be seen with a microscope?
- To what extent do we ask these types of questions of ourselves in similar contexts?

Practice Session –Q1

The Thames Tideway Tunnel (TTT), at an estimated cost of £4.2 billion, has the goal to increase the capacity of London's existing brick Victorian sewage system to meet the strains it faces today. The TTT will collect and store the regular overflow of almost 40 million tonnes of rainwater and sewage each year, before pumping it to a water treatment plant outside London. Some of the sewage will be used to generate a moderate amount of methane gas; a renewable form of energy. The 9-year project has been scrutinised for failing to consider cheaper and other environmentally beneficial alternatives, such as resurfacing roads with porous asphalt, repurposing walls and roof space for gardens and segregating rainwater from untreated sewage.

The Thames Tideway project has an assumed cost of £4.2 billion.

A. Definitely True
B. Probably True
C. Insufficient Information
D. Probably False
E. Definitely False

Answer: A

Practice Session –Q2

The Red Bus stops every 10 minutes.
The Green Bus stops every 20 minutes.
Both buses stop at Lansdowne Road
The Red Bus has twice as many stops as the Green Bus

The two buses never stop at Lansdowne Road at the same time.

A. True
B. Insufficient Data
C. False

Answer: B

Practice Session –Q3

Multivitamins supplements containing all vitamin types are taken by an average of 30% of adults. Many have Vitamin D deficiency – the production of which is aided by sunlight. Daily takers tend to be more health-conscious than others. People may rely on multivitamins to prevent deficiencies.

Multivitamin supplements are always taken daily.

A. Conclusion Follows
B. Conclusion Does Not Follow

Answer: B

Practice Session –Q4

Should zero-hour contracts be used to help young people get into work?

No; there are other methods to achieve the same result.

A. Very Strong Argument
B. Strong Argument
C. Fairly Strong Argument
D. Fairly Weak Argument
E. Weak Argument

Answer: E

Practice Session –Q5

Would differential cash bonuses for high productivity be beneficial to the workplace?
No. Differential bonuses have been found to create a hostile working environment, which leads to a decrease in the quality and quantity of products.

A. Strong
B. Weak

Answer: A
Schema of statement: Differential cash bonuses (productivity↑)→ workplace↑
Explanation: This argument targets both the action and the consequences of the action on the object of the statement. It states that the action (implementing differential cash bonuses) has a negative effect on the workplace (a decrease in quality and quantity of products). Therefore, it is an important argument, one that is relevant for the workplace. Note that this argument does not specifically target differential cash bonuses. Still, they are considered a sub-group of the subject of the argument (differential bonuses).