

# PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT

## PISA

### KNOWLEDGE OF SCIENCE

### &

### KNOWLEDGE ABOUT SCIENCE

### DAY: 3

### SESSION : 1

KNOWLEDGE



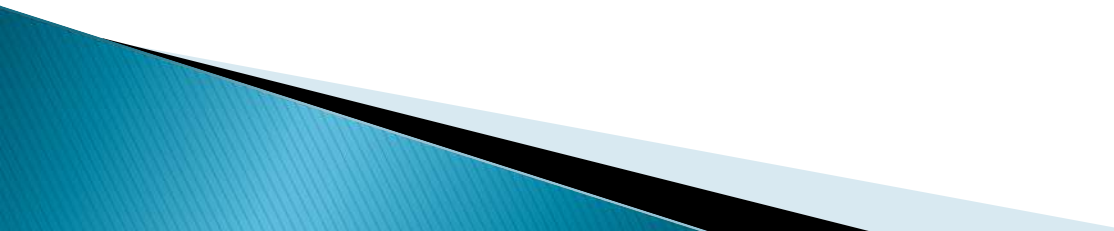
SCIENCE

METHODS OF TEACHING  
SCIENCE

# KNOWLEDGE OF SCIENCE

1. PHYSICAL SCIENCES
  2. LIFE SCIENCES
  3. EARTH SCIENCES
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# Competencies required for scientific literacy:

- Competency 1: Explain phenomena scientifically
  - Competency 2: Interpret data and evidence scientifically
  - Competency 3: Evaluate and design scientific enquiry
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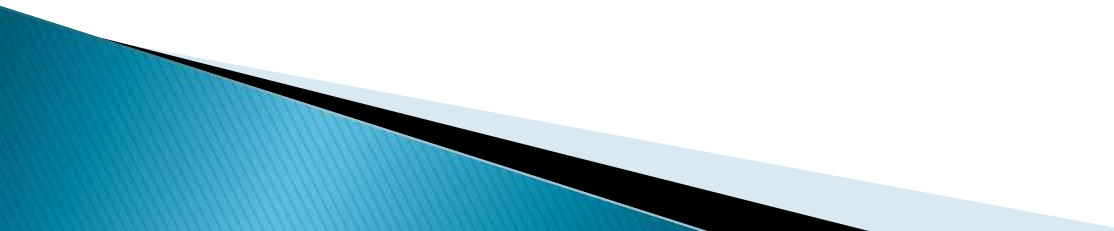
# KNOWLEDGE ABOUT SCIENCE

1. PROCEDURAL  
KNOWLEDGE


2. EPISTEMIC KNOWLEDGE



**TENTATIVENESS** : SCIENTIFIC  
KNOWLEDGE EXCHANGES OVER  
TIME AS NEW DATA IS DEVELOPED  
AND OLD DATA REINTERPRETED.  
WHILE THIS KNOWLEDGE MAY  
CHANGE OVER TIME--- RELIABLE  
ENOUGH FOR MANY SCIENTIFIC  
ADVANCES TO OCCUR



**SOCIAL & CULTURAL CONTEXT:**  
SCIENTISTS AND THE PRACTICE OF  
SCIENCE EXIST WITHIN A CERTAIN  
SOCIAL AND CULTURAL CONTEXT.  
THIS SOCIAL AND CULTURAL  
CONTEXT MAY SHAPE THE KINDS  
OF QUESTIONS , METHODS AND  
INTERPRETATIONS USED BY  
SCIENTISTS.



# CREATIVITY:

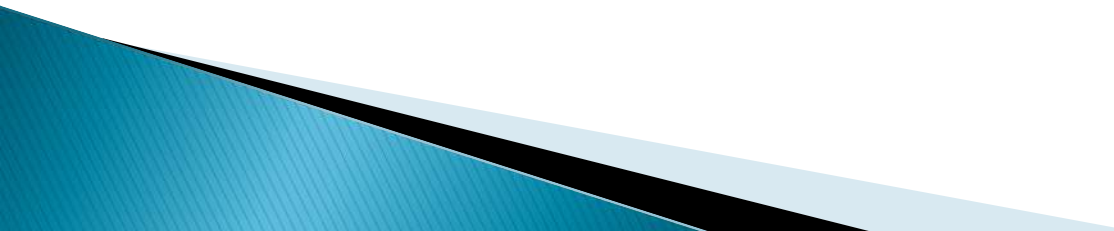
SCIENTISTS ARE CREATIVE AS  
THEY GENERATE EXPLANATIONS  
OF EVIDENCE.

DATA DOES NOT INTERPRET  
ITSELF.

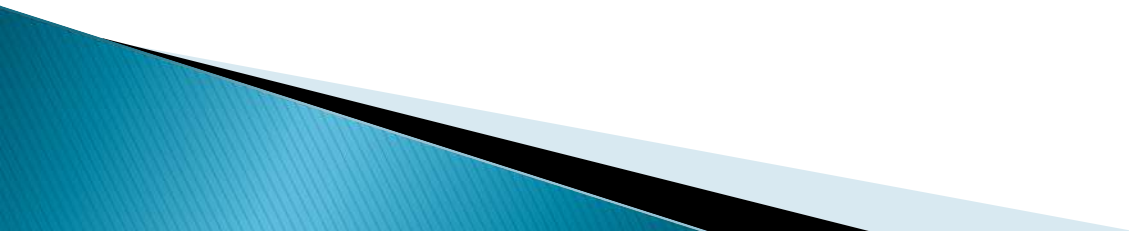




**CURIOSITY** (WANTING TO RAISE  
QUESTIONS AND TO FIND OUT  
ANSWERS)  
RESPECT FOR EVIDENCE  
(WILLINGNESS TO GATHER AND  
TAKE ACCOUNT OF EVIDENCE TO  
TEST IDEAS)

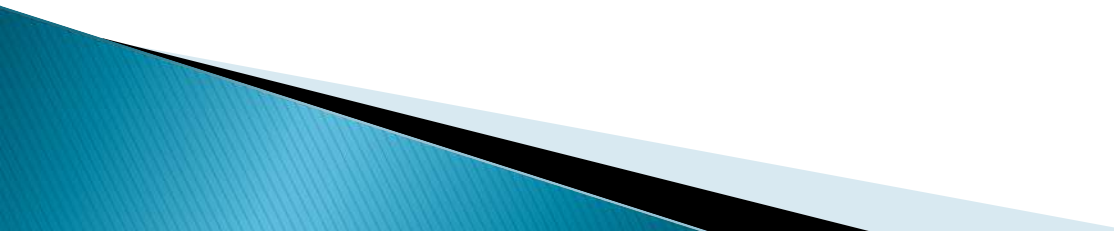


**OPEN-MINDEDNESS  
(WILLINGNESS TO CHANGE  
IDEAS IN THE LIGHT OF  
EVIDENCE)**

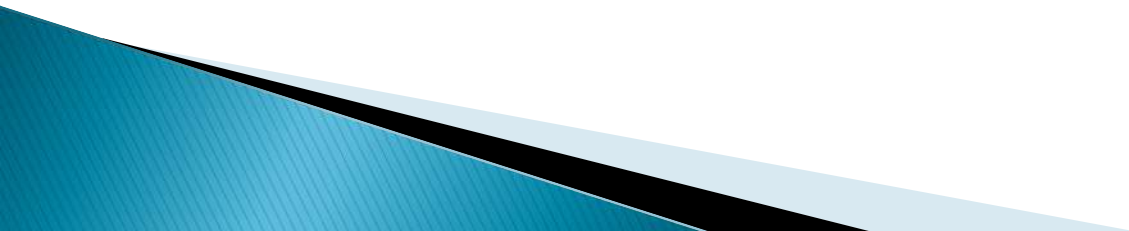


# **CRITICAL REFLECTION**

(WILLINGNESS TO REVIEW  
THE IMPLICATIONS OF  
NEW IDEAS AND EVIDENCE  
FOR HOW THINGS PREVIOUSLY  
ENCOUNTERED WERE  
UNDERSTOOD)

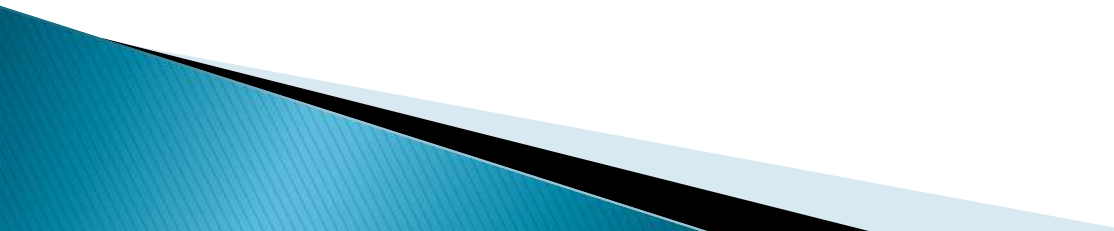


SENSITIVITY TO THE LIVING  
AND NONLIVING ENVIRONMENT  
(AVOIDING HARM TO THE  
SUBJECTS OF INVESTIGATION)

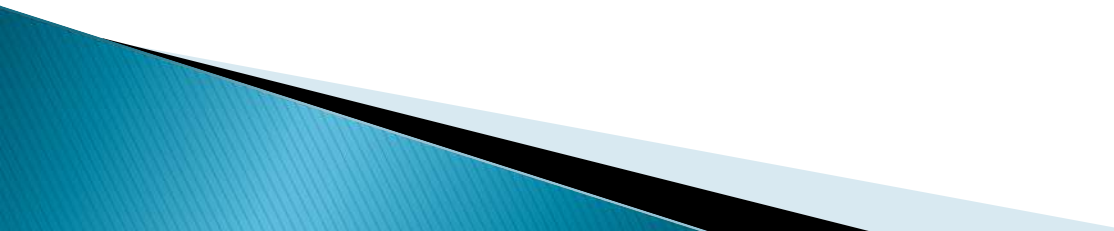


# **SUBJECTIVITY:**

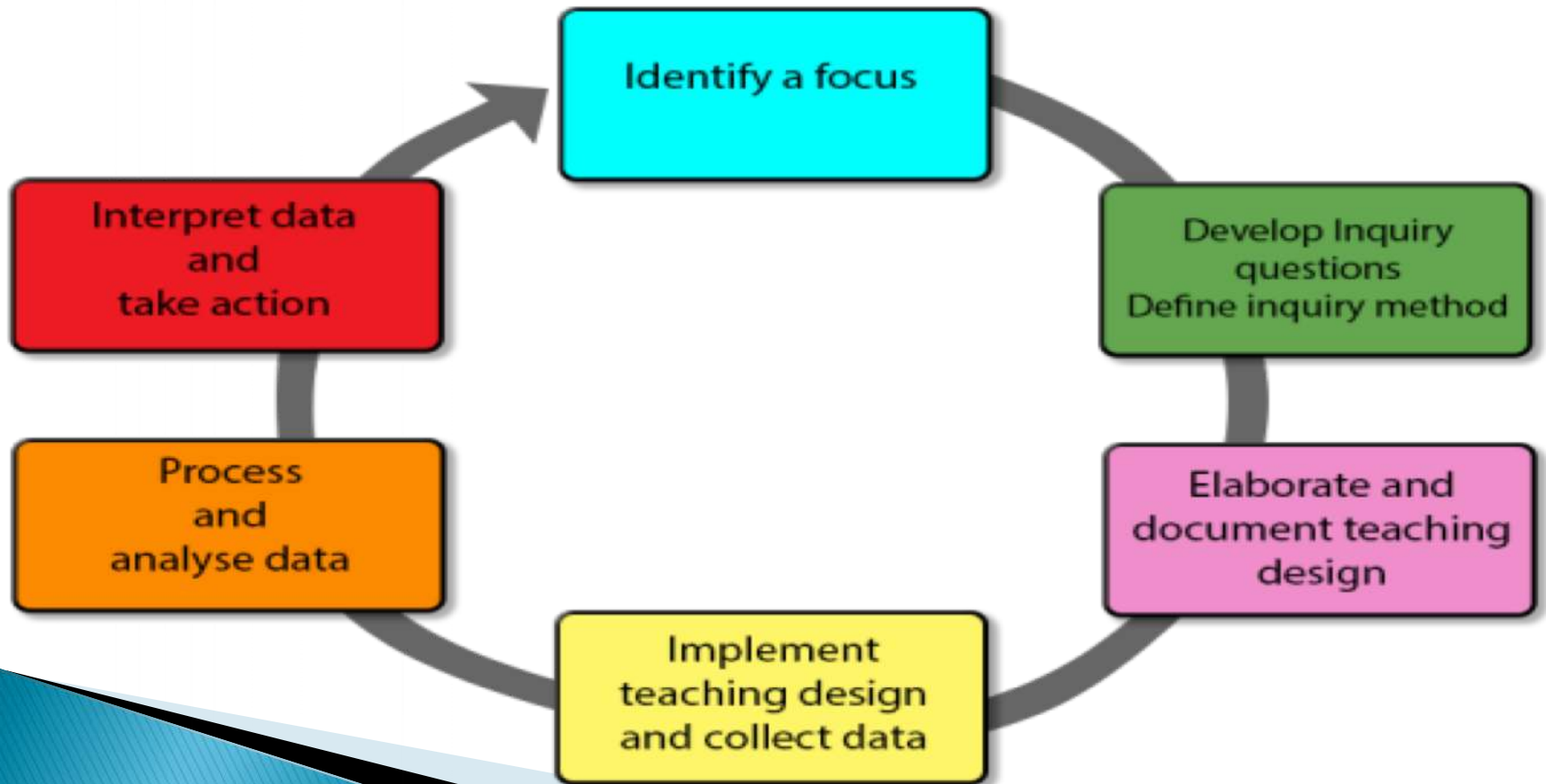
**SCIENTISTS ARE PEOPLE WHO HAVE THEIR OWN BACKGROUND KNOWLEDGE AND THEORETICAL PERSPECTIVES. WHEN THEY MAKE OBSERVATIONS “SEE” THE INFORMATION IN THE LIGHT OF THESE PERSONAL PERSPECTIVES.**



**OBSERVATIONS VS INFERENCES :**  
SCIENTISTS MAKE OBSERVATIONS OF  
NATURAL PHENOMENA AND MAKE  
INFERENCES AS TO WHAT THESE  
DATA MEAN?



# EMPERICALLY BASED SCIENTIFIC KNOWLEDGE IS BASED ON EVIDENCE



# **KNOWLEDGE ABOUT SCIENTIFIC INQUIRY**

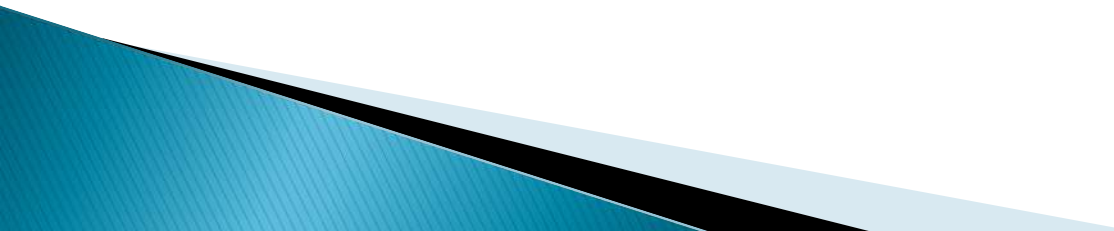
**SCIENTIFIC INVESTIGATIONS  
ALL BEGIN WITH A  
QUESTION, BUT IT IS NOT  
NECESSARY.**

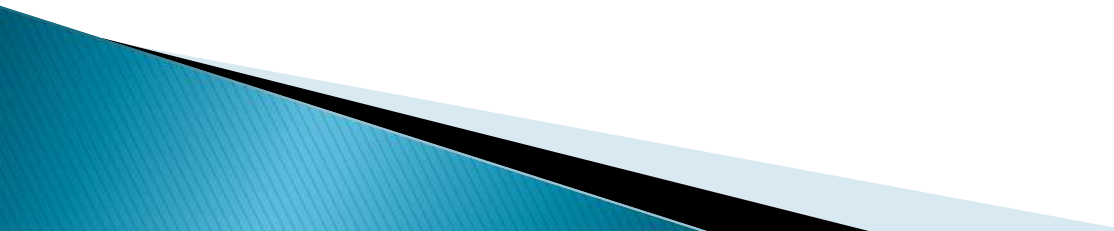
**TEST A HYPOTHESIS**





**THERE IS NO SINGLE SET  
AND SEQUENCE OF STEPS  
FOLLOWED IN ALL  
SCIENTIFIC INVESTIGATIONS**

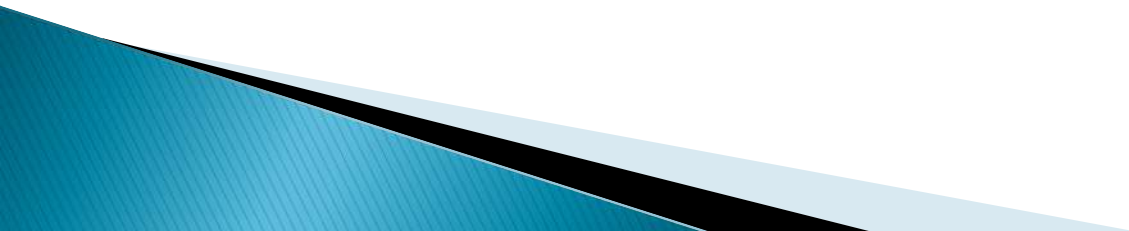


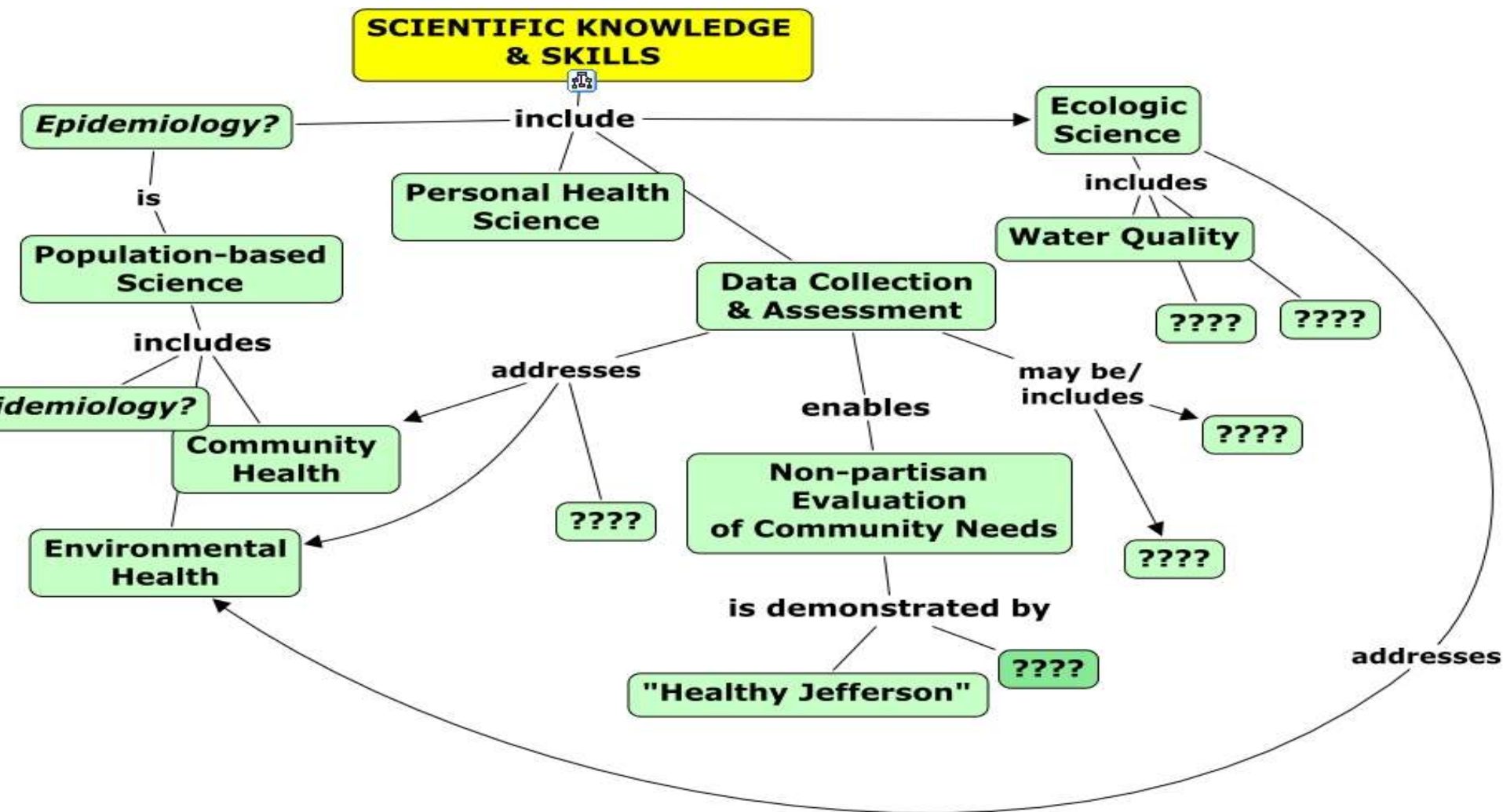
- **ALL SCIENTISTS PERFORMING THE SAME PROCEDURES MAY NOT GET THE SAME RESULT**
  - **INQUIRY PROCEDURES CAN INFLUENCE THE RESULT**
- 

- RESEARCH CONCLUSIONS MUST BE CONSTANT WITH THE DATA COLLECTED

- SCIENTIFIC DATA ARE NOT THE SAME OF THE SCIENTIFIC EVIDENCE

**EXPLANATIONS ARE DEVELOPED  
FROM A COMBINATION OF THE  
COLLECTED DATA AND WHAT IS  
ALREADY KNOWN**





Jean -

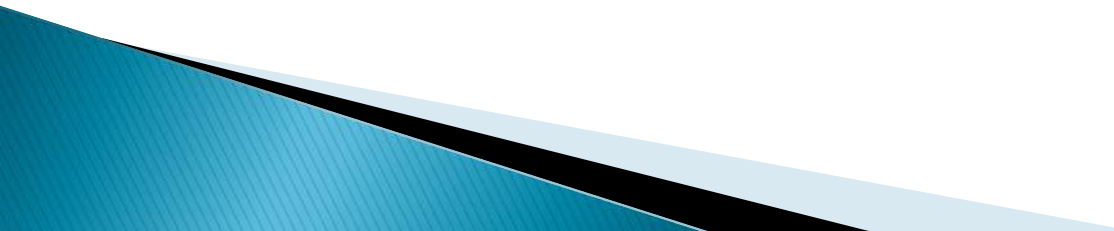
1. Is epidemiology the super-ordinate concept or a sub-concept of "Population-based Sciences?"

2. What are the most effective the top level concepts for this concept map - "Ecologic Science" and "Population-based Science"? --- OR - for purposes of education and communication, would it be more effective to have 3-5 top level concepts that convey scientific concepts - e.g, "Epidemiology", "Data Collection & Assessment." ???, ???

Indigenous Knowledge	Scientific Knowledge
assumed to be the truth	assumed to be a best approximation
sacred and secular together	secular only
teaching through storytelling	didactic
learning by doing and experiencing	learning by formal education
oral or visual	written
integrated, based on a whole system	analytical, based on subsets of the whole
intuitive	model- or hypothesis-based
holistic	reductionist
subjective	objective
experiential	positivist

# **LAWS VS THEORY:**

BOTH LAWS AND THEORIES ARE VERY IMPORTANT IN SCIENCE. THEORIES AND LAWS HAVE DIFFERENT JOBS. LAWS ARE STATEMENTS OF PATTERNS AND REGULARITIES IN THE NATURAL WORLD. THEORIES ARE EXPLANATIONS FOR THOSE PATTERNS. SCIENTIFIC LAWS AND THEORIES ARE BOTH WELL-SUBSTANTIATED AND HAVE MUCH EVIDENCE TO SUPPORT THEM.





**TEACHER-CENTRED METHODS**

**LEARNER -CENTRED METHODS:**

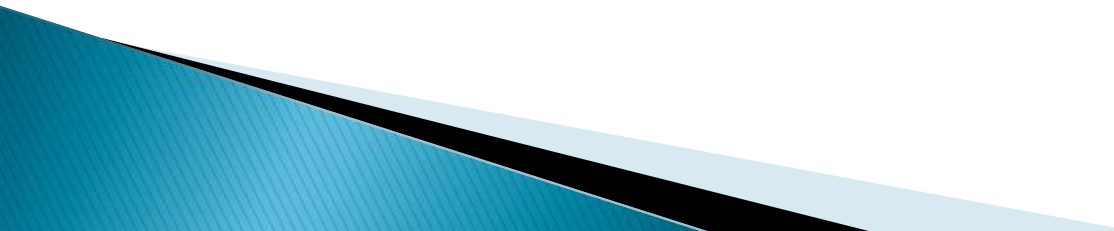




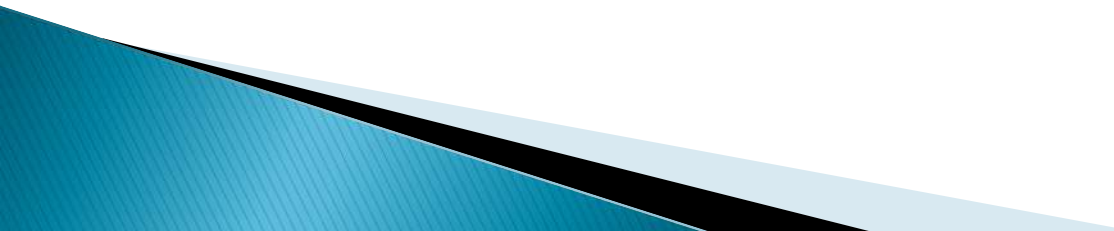
# PRINCIPLES FOR SELECTING METHODS:-

- There are some guiding principles for determining teaching methods.

They are as follows:

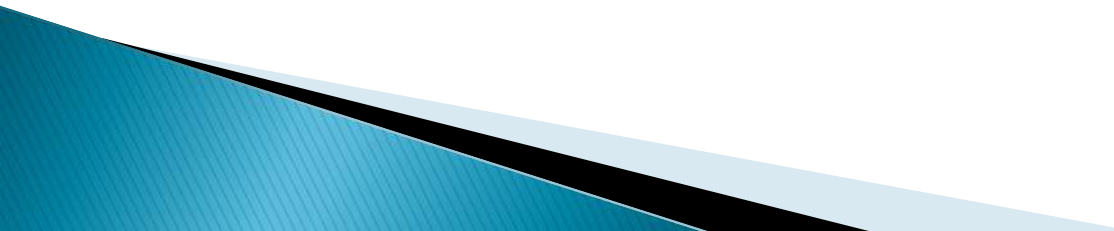
- Principle of sense of achievement through interest and purpose.
  - Principle of active cooperation.
  - Principle of capability of students of particular class.
  - Psychological principle i.e., need and interest of students.
- 

## **MERIT OF LECTURE-DISCUSSION METHOD:**

- It creates democratic environment in the class.
  - Develops and improves communication of students.
  - It brings about attitudinal change among students.
  - It helps in assessing the factual knowledge the students.
- 

- **LABORATORY METHOD:**

- **PRINCIPLES OF LABORATORY METHOD:**

- It follows the principle of learning by doing.
  - It follows psychological principle, where students age and interest is taken into consideration.
  - The work should be Pre-organized and Pre-selected.
  - Teacher must see that, students are allowed to work independently without much interference.
  - The teacher must ensure that apparatus is checked and spare in hand.
  - Teacher must see that students are able to follow instruction and record their observation properly.
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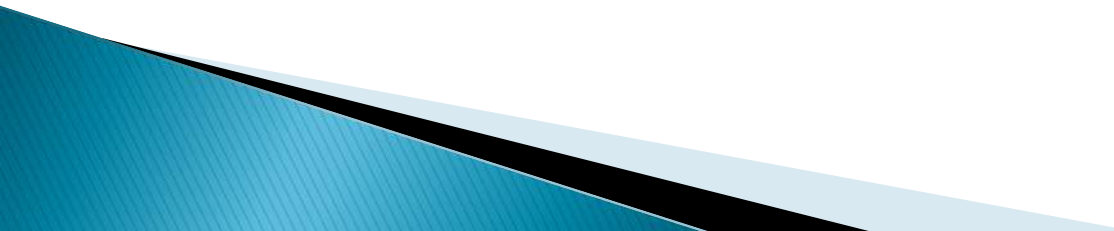
# **OBSERVATION METHOD:**

## **PRINCIPLES OF OBSERVATION:**

- ☐ **Principle of freedom.**
  - ☐ **Principle of experience.**
  - ☐ **Principle of play-way.**
  - ☐ **Principle of individual effort.**
  - ☐ **Principle of activity.**
  - ☐ **Principle of logical thinking.**
  - ☐ **Principle of purpose fullness.**
- 

# PROJECT METHOD

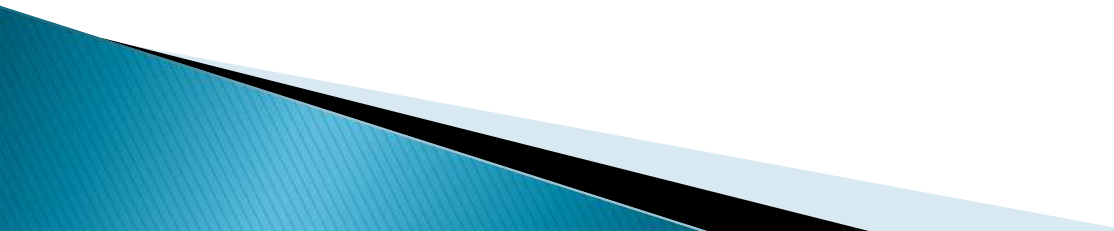
## PRINCIPLES OF PROJECT

- ☐ The Principle of purpose.
  - ☐ The Principle of activity.
    - ☐ The Principle of interest.
    - ☐ The Principle of utility.
  - ☐ The Principle of correlation.
  - ☐ The Principle of sociability.
  - ☐ The Principle of experience.
    - ☐ The Principle of reality.
  - ☐ The Principle of learning by doing.
- 

# PROBLEM SOLVING METHOD

## PRINCIPLES OF PROBLEM SOLVING METHOD

❖ Principle of learning by doing.

- ☐ Principle of purpose.
  - ☐ Principle of freedom of thought.
  - ☐ Principle of learning by experiencing.
  - ☐ Principle of utility.
  - ☐ Principle of scientific attitude.
  - ☐ Principle of interest.
  - ☐ Principle of reality.
  - ☐ Principle of concreteness.
  - ☐ Principle of objectivity.
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# Inquiry Cycle



**THANKS**