केन्द्रीय विद्यालय संगठन

KENDRIYA VIDYALAYA SANGATHAN

FACILITATORS MANUAL 2019

FRAMEWORK

Capacity Building Programme for Science Literacy

आंचलिक शिक्षा एवं प्रशिक्षण संस्थान,मुंबई-400078

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Framework

Capacity Building Programmes for Science Literacy

Facilitators' Manual

2019

Session Designs

Scientific Literacy

The Capacity Building Programme will be a 02 Days' hands on workshop. The Programme Design proposes a 10-hour long schedule. A tentative schedule is detailed below.

Schedule of the Programme

Day 1

Time	Session
8.30 am-9.00 am	Registration and other formalities
9:00 am - 9:30 am	Ice Breaking and Introduction to the CBP. Introduction of the Participants /Facilitators
9:30 am – 10:00 am	**Session 1**: Introduction and overview of PISA
10:00 am – 11:00 am	**Session 2:** Discipline of Science
11:00 am – 11:15 am	**Tea Break**
11-15 am -12-15 noon	**Session 3:** Review of PISA's Scientific Literacy Framework
12:15 am - 01:15 pm	**Session 4**: Broadening Horizons of Science Learning_ I
1:00 pm -1:45 pm	**Lunch**
1:45 pm – 2:45pm	**Session 5:** Broadening Horizons of Science Leaning _II
2.45 pm – 3.00 pm	**Break**
3:00 pm – 4:00 pm	**Session 6:** Knowledge of Science and the Knowledge about Science
4.00 pm – 4.30 pm	Review and planning for the next day

Day 2

Time	Session
9:00 am – 9:45 am	**Session 1**: Assessment for Learning (AFL)
9:45 am - 10:45 am	**Session 2:** Creating the AFL classroom
10:45 am – 11:00 am	**Break**
11-00 am -12-00 noon	**Session 3:** Developing Questions_ Guided Work
12:00 am - 01:00 pm	**Lunch**
1:00 pm -1:45 pm	**Session4:** Developing Questions _ Guided Work
1:45 pm – 02 : 45pm	**Break**
2.45 pm – 4:00 pm	**Session 5:** Science all around us
4.00 pm – 4.30 pm	**Session 6:** Feedback and Valedictory

SESSIONS AT A GLANCE

S.No.	Day 1	Topic	Presentation	No: of Slides
1.	Session 1	Introduction and overview of PISA	Yes	40
2.	Session 2	The Discipline of Science	Yes	25
3.	Session 3	Review of the PISA's Science Literacy Framework	Yes	29
4.	Session 4	Broadening Horizons of Science Learning_ I	Yes	24
5.	Session 5	Broadening Horizons of Science Learning_ II	Yes	38
6.	Session 6	Knowledge of Science and Knowledge about Science	Yes	32
	Day 2	Topic	Presentation	
7.	Session 1	Assessment for Learning	Yes	41
8.	Session 2	Creating the AFL Classroom	Yes	28
9.	Session 3	Developing Questions_ Guided Work	Yes	105
10.	Session 4	Developing Questions_ Guided Work	Yes	
11.	Session 5	Science all around us	Yes	47
12.	Session 6	Feedback and Plenary	X	X

Brief Overview of each Session

DAY-1

Session 1

Ice breaking and Introduction

A brief ice breaking introductory session with some Science related activity. This may be followed with an introduction of the Programme, the facilitator and the participants

Session 2

The Discipline of Science

Science as a discipline is a body of knowledge that represents current understanding of natural phenomenon around us. It as well signifies the processes whereby that body of knowledge has been established and is being continually extended, refined and revised. Understanding the nature of science is crucial for effective science teaching. Why teach science can largely be understood in terms of

- Increasing students' understanding of science content.
- Increasing student's inquisitiveness in everyday phenomenon and develop scientific thinking to enable them to make decisive on the basis of reliable knowledge.
- Make students aware of socio-scientific issues viz. should I oppose or support the building of nuclear power stations

The participants in later half of the session can reflect on their classroom scenario and make observation on the achievement of above-mentioned outcomes.

Session 3

Review of PISA's Scientific Literacy Framework

This session may begin with a brief recapitulation of the *What* and *Why* of PISA. The important message to convey are:

- Benchmarking students on global standards is not a choice today, but a necessity.
- The important responsibility of teachers and school administration to reflect on teaching, learning and assessment practices and to adopt those that prepare our students to become responsible citizens of the 21st century.

In the subsequent session, the Science Literacy Framework of 2015 of OECD would be reviewed. The session will also motivate teachers to examine the Science Curriculum (NCERT/CBSE) and the Science Learning Outcomes (NCERT) and examine these in the light of the PISA Framework. The common elements may be highlighted.

Session 4 and 5

Broadening Horizons of Science Learning

These 02 sessions would highlight emerging new dimensions that add value to the teaching of Science. Participants would examine the teaching and learning of Science from the perspective of *Constructivism*; review the need of a *Historical Perspective* for teaching Science; and examine the benefits of *Reading* for Science learning.

Constructivism: The dominant paradigm which sees learners as active involvement in construction of meaning from their experiences- the focus being on generative learning and inquiry strategies (explorative and problem solving) in learner centric classrooms.

Historical Perspective: A historical perspective in teaching and learning Science is important to help learners appreciate that the nature of Science itself is in flux. While the image of certainty of scientific knowledge is challenged at the same time it can be seen that uncertainty of a scientific theory does not necessarily nullify its usefulness. It also leads to a firmer grasp of concepts and helps learners appreciate the role played by great scientists of the past.

Reading: A preview of the PISA items reflects the need for a larger vocabulary and fluency in our learners. Exposure of our learners to reading text that is related to Science and Technology would be a preparatory step for this assessment.

Further, it is emphasized that although hands-on and inquiry approach to learning Science are extremely valuable, the engagement of learners with literature (nonfiction and fiction) in Science is an important input and crucial way through which students learn Science.

Books/ Readings

Magic School Bus Series

Hindu- Young

Down to Earth

Goober Times

Terra Green

Session 6

Knowledge of Science and Knowledge about Science

As discussed in the earlier Session on *Review of the Scientific Framework of PISA,* Science learning happens within a range of contexts and learners acquire relevant competencies and knowledge accordingly. The knowledge acquired can be distinguished as 'Knowledge of Science' and the 'Knowledge about Science'. **This session will focus upon these 02 aspects.**

Knowledge of science- As a hands-on task, the participants may be asked to map a sample of PISA test items on the categorized areas under *Knowledge of Science.* The key take-away would be the teachers' sensitization that the diversity of areas covered in testing in PISA can be categorized into a few themes and that these themes are the ones that our students cover in the courses they study.

Knowledge about science- The focus here is on processes i.e. the way *Scientific Enquiry i*s undertaken and what comprises *Scientific Explanations*. Detailing of the processes of Science (with examples) and various explanations and their distinction would be dealt upon.

From PISA Framework-2010

Scientific enquiry

- **Origin (e.g. curiosity, scientific questions)**
- **Purpose (e.g. to produce evidence that helps answer scientific questions, current ideas/ models/theories guide enquiries)**
- **Experiments (e.g. different questions suggest different scientific investigations, design)**
- **Data (e.g. quantitative [measurements], qualitative [observations])**
- **Measurement (e.g. inherent uncertainty, replicability, variation, accuracy/precision in equipment and procedures)**
- **Characteristics of results (e.g. empirical, tentative, testable, falsifiable, self-correcting)**

Scientific explanations

- **Types (e.g. hypothesis, theory, model, scientific law)**
- **Formation (e.g. existing knowledge and new evidence, creativity and imagination, logic)**
- **Rules (e.g. logically consistent, based on evidence, based on historical and current knowledge)**
- **Outcomes (e.g. new knowledge, new methods, new technologies, new investigations**

DAY-2

Session 7

Assessment for Learning

Quality assessment is central to good teaching and is inevitably a key component in learning environments that facilitate students' learning with understanding (Donovan & Bransford, 2005). This session would address the concept of Assessment as a tool for learning. Various assessment strategies and techniques may be highlighted. Sample QP containing different types of test items may be given to the participants for analysis.

(am attaching 2 documents on assessment for reference and possible use)

Session 8

Creating the AFL Classroom

This session would focus on classroom transactions; how assessment should be embedded in teaching-learning; the powerful role of teacher questions; and classroom discourse/ dialogues.

Session 9 and 10

Developing Questions-Guided Work

Session 9 and 10 would give the participants hands-on experience of developing competency-based questions. The teachers may be guided to develop test questions that are competency based. Scaffolding cues in the form of context text sample may be provided by the facilitator.

Session 11

Science All Around Us

This session would focus on the interlinkages of the concepts taught in the class with the world around us; and with other disciplines. The key message would be to use everyday ideas/ conversations/context to teach Science.

Session 12

Feedback and Valedictory

BRIEF GUIDELINES

TO MASTER TRAINERS (MT) FOR THE CONDUCT OF THE 3-DAY REGIONAL LEVEL WORKSHOP ON CAPACITY BUILDING FOR TEACHER'S OF SCIENCE

SEPTEMBER 2019

DAY:1	HINTS / BRIEF GUIDELINES
SESSION:1	**Introduction and Overview of PISA** • Open the session by asking participants, if they have heard about PISA and what do they know in brief. • Once they share, elaborate; using the given PPT, the MT may share more about PISA, its objectives, India's participation and the goals we are striving to achieve. • The role of Science teachers and the significant role played by them. Boost their morale from the beginning by making them feel good and also important in the KVS setup.
SESSION:2	**The Discipline of Science** • PPT on The Discipline of Science, provided to be used to explain the systematic approach to the study of Science. Use of various pedagogical strategies to inspire and encourage Science Learning in Students. • Five suggested Teaching techniques i) Real-life scenarios that involve case studies ii) Ways of analyzing current problems iii) Peer-to-peer teaching, which involves students in their own education iv) Hands-on activities that engage students beyond the lecture • Teach useful scientific concepts
SESSION:3	**Review of the PISA'S Scientific Literacy Framework** • Using the given PPT elaborate on what exactly is meant by Scientific Literacy, under PISA. • The three Competencies that need to be developed in our Learners Namely:

	i) Explain Phenomena scientifically ii) Interpret data and evidence scientifically iii) Evaluate and design scientific enquiry • Inform them the conceptual framework defines five contexts, each of which may have a **personal, social or global reference:** **i) health and disease** **ii) natural resources** **iii) environment quality** **iv) hazards** v) **the frontiers of science and technology**
SESSION:4	**Broadening Horizons of Science Learning-I** • PPT provided to bring across to the participants that Science has a vast historical background. Lots of perseverant hard work by many Scientists from different parts of the world go into the discovery of various Scientific Phenomena and many a times after all these, years later further studies and advanced facilities disprove the earlier findings completely at times or bring about modifications. In other words, Science is ever evolving. This is to instill a sense of awe in the students, apart from encouraging them towards hard work and not to get disheartened by failures, if any during their research or study.
SESSION:5	**Broadening Horizons of Science Learning-II** • PPT provided to be used to explain that Broadening Horizons of Science Learning II. Learning as per various theories. Constructivism and that Learning is building up on already existing Knowledge and the role of Social Constructivism in Learning. • Thus, the teachers may be encouraged to include group work, peer learning, survey method etc. to bring about learning.

SESSION:6	**Knowledge of Science and the Knowledge about Science** • PPT provided to be used to explain that the Knowledge of Science is essential to understand the various theories and laws. All the relevant information for the same is in the various textbooks referred to by teachers and students. • But that would not serve the purpose, if we do not use the same in our daily lives both consciously and unconsciously. In other words, using the Knowledge of Science judiciously. Epistemology would be the extension of this knowledge for the day to day activities, research, discoveries as well as innovations.
DAY:2	
SESSION:1	**Assessment for Learning (AFL)** • PPT provided to be used to explain the significance of Assessment. The types of assessments, namely assessment for learning; assessment of learning and assessment as learning. • Emphasis should be on Assessment for learning, as our primary goal is to empower our students by inculcating love for Science and also promoting curiosity and self-learning.
SESSION:2	**Creating the AFL Classroom** • Participants to be drawn into a discussion on how they could create the AFL Classroom. • PPT provided to be used corroborate as well as provide insights into creating the AFL Classroom.
SESSION:3	**Developing Questions-Guided Work** • PPT provided to be used to explain the how to develop questions and the seven levels of Proficiency in Science as envisaged in PISA. Performance of students to be gauged on various levels based on their proficiency in Science. • Sample questions to be shown and discussed.

SESSION:4	**Developing Questions-Guided Work** • Hands on session, where the participants are encouraged to make just one such Question (group work in pairs) on any of the 5 Contextual areas of Science in PISA as already listed and given to the participants. • PPT provided to be used to explain the seven levels of Proficiency in Science as envisaged in PISA. Performance of students to be gauged on various levels based on their proficiency in Science. • The format given for Seven levels of Proficiency in Science may be used by the participant, to categorize the sample questions given to them, as an exercise to grade the questions under different levels as per their perception. This would give them an insight into the Seven levels of Proficiency in Science
SESSION:5	**Science all around us** • PPT provided to be used to explain that Science is truly all around us. An alert and conscious mind can , not only see's the Science around us, but also observes, explains, understands , extrapolates all that which is obvious and also not so obvious. E.g. Rainfall, evaporation, photosynthesis etc. to name a few. Appreciate the same and contribute as an individual, as community towards the safe keeping of Earth and its resources for generations to come! • This can help students come out with out of the box solutions for Water Conservation, Conservation of electricity, Disposal of plastics, reuse of plastics et al.
SESSION:6	• Feedback from participants about the workshop and suggestions from them for future workshops. • Valedictory

1. INTRODUCTION

The National Policy on Education 1986 regards human being as a positive asset and envisages the role of education as to develop manpower for different levels of the society. The role of Science Education in this regard was aimed to develop well defined abilities and values such as the spirit of inquiry, objectivity, the courage to question and an aesthetic sensibility in a child. Further, while speaking about the design of Science Education programmes, it expresses a desire to enable the learner to acquire problem solving and decision-making skills and to discover the relationship of Science with health, agriculture, industry and other aspects of daily life.

The edifice of the National Curriculum Framework 2005 is erected on the pillars of 5 guiding principles of which **"Connecting Knowledge to Life outside the School is listed at the top".** Further, when elaborating on good Science Education, it speaks about a basic criteria of validity of a Science curriculum namely:

- Cognitive validity
- Content validity
- Process validity
- Historical validity
- Environmental validity
- Ethical validity

A careful look on these aspects will clearly elucidate the impact and implications of Science Education for the productive and successful functioning of the individual in the life beyond school.

PISA, primarily assesses the Student's competency in three major domains, i.e. Reading Literacy, Scientific Literacy & Maths Literacy. Scientific Literacy implies not just the Knowledge of Science but also the Knowledge about Science and its necessity in day to day life.

Objectives of teaching Science: The objective of school Science curriculum at elementary and secondary level is to provide students opportunities to be equipped with important Science needed for better educational, professional and social choices. It empowers students to investigate, to make sense of and to construct Scientific meanings from new situations. By learning Science students must be able to develop logical thinking and reasoning. They must also be able to find out Science in all walks of life including art. They should not find the subject in isolation with other subjects or life. Rather be able to make use of their learning in day to day life.

Present status of Science Learning

Various educational surveys and achievement data over the years show that learning achievements of children in various subjects-especially Science- are not up to the expected levels despite all the efforts made by states in this direction. It is a fact that many a time, teachers complete the syllabus as per the textbook, but they do not have a clear idea about the kind of learning they expect from children in various subjects including Science. The curricular expectations as defined by NCERT are not met.

Importance of teacher empowerment

Learning is a continuous process. The learning outcomes are impacted by the learning and pedagogical processes used to develop competencies. The learners are expected to realize and use Science as an important tool that they can talk about, use and explore as well as understand its structure. This will happen only if the teachers have necessary competencies and motivation to do so. Thus, teacher empowerment plays a crucial role in this respect.

About this Manual

The Manual gives inputs on conducting two days session on Science Literacy with a special focus on PISA with reference to the content, process and the context involved. It is expected that teachers will make use of this manual for Assessment to be integrated in the classroom transactions. Pedagogical strategies including Assessment for learning are discussed in detail with a special emphasis on connecting Science to daily life, an inter disciplinary approach to Science learning and practice in daily life. We hope this manual will help in giving a direction to the teacher to improve the competencies of children in Science so they can face the challenges of day to day life in the 21st Century.

NOTE FOR FACILITATOR

Science is often considered a dreaded subject for learners. This fear of Science makes it difficult for teachers to make Science learning enjoyable for learners. Teachers have to make learning Science an interesting task for learners despite the constraints of time and resources. Addressing individual differences in learners is also a challenging task for teachers. Apart from planning and enhancing one's knowledge and skills, this requires a will to improve the teaching-learning process. This manual is an attempt to facilitate teachers in this endeavor.

As a facilitator, you are expected to provide course participants with a situation to bring out the knowledge and skills of participants who are experienced, creative and resourceful. A facilitator has to use his or her experience and expertise in mentoring the course participants and encourage the art of

self-analysis and reflection. This manual provides some guidelines in this regard but in no way does it limit the scope of discussions or the sessions. As per the interest, experience and proficiency of the course participants, you are advised to make suitable additions and modifications in the content being discussed. Further, it is imperative that the facilitator thoroughly reads this manual and plans for any additional resources required during this programme.

Things to check before the workshop

- **The teaching rooms:** adequate furniture/seating, board, marker pens, duster, ventilation, fans, notice board, electric points etc.
- **Break times:** Arrangements for drinking water, tea, meals etc.
- **Transport arrangements** (where applicable)
- **Resources:** location and availability of reprographic facilities, paper, pens, markers, speakers for audio and video clips and other material.
- **Workshop materials:** adequate supplies of all the handouts, CDs with PPTs and resource videos with internet connection, etc., writing pads for teachers, folders, pens, etc.

OVERVIEW:

- **Why these guidelines?**

  The training guidelines contain **session-wise instructions** for the master trainers to conduct a three - day training workshop for **teachers of English teaching classes VII to X** in Kendriya Vidyalayas. The objective is to help MTs train teachers for developing Scientific Literacy among the students.

- **What do the guidelines contain?**

  It has a three-day schedule. It details out important do's and don'ts that trainers need to take care of before the actual training starts. They must create a conducive environment for participants to share their experiences and concerns.

  The MTs are expected to **follow the guidelines** and the proposed methodology as outlined in the given schedule. Each session contains step wise instructions for the MTs. Handouts to be given to the course participants are listed with each session along with the presentations that are to be shown.

  The **guidelines** also detail out **different training strategies** such as - group work, pair work, discussion and individual/group presentations, which promote the realization of a participatory

interactive learning approach and promoting quality training as well as active participation by all course participants.

How to use the Guidelines?

The Guidelines contain 18 Sessions on Academic areas. The instructions given with each session are self - explanatory. It is visualized that the **trainer will be a facilitator** and therefore the content will be delivered through an interactive participatory approach by them.

To promote and facilitate this approach some **important tips are included** that can be referred to by the trainers. **Different strategies** that promote participatory and interactive training are also detailed out. What is important is that **MTs** use these strategies during training so that **CPs** get a real feel and experience how they in turn will undertake quality teaching learning processes in their classrooms with children. Finally, it is critical and necessary that all **17 sessions** are **a total comprehensive package** and not in isolation for the training to be transacted effectively.

MT= Master Trainer

CP=Course Participant

General Objectives of the Capacity Building Workshop:

- **To sensitize all the participants regarding PISA**
- **To apprise participants about the cognitive domain of Scientific literacy**
- **To train the teachers concerned, to prepare students (of classes VI to IX, at present) to face the challenge of PISA 2021**
- **To familiarize the teachers to a wide range of PISA Test Items**
    - **To make them aware of different text types, Response formats, scoring rubrics etc.**
    - **To train them in different Scientific strategies**
- **To evolve a plan to promote Scientific Literacy using best practices in the classroom**

Master Trainers can take a Printout of the Objectives and place it at a vantage point in the Resource Room.

Tips to Trainers

Some Do's

- Arrive early each day for all three days. Arrange the seating to your liking, and make sure you are there to welcome participants in a warm and encouraging way.
- Encourage active participation.
- Listen, actively and openly, to participants' views.
- Ensure that course participants (CPs) listen to each other in discussion.
- Acknowledge and affirm participants' contributions.
- Clarify their doubts patiently.
- Know your plan for each session.
- Agree on a signal (a raised hand) to stop discussions without stress and strain.
- Ensure that each individual has an equal chance to contribute.
- Repeat instructions before starting a session or an activity.
- Maintain eye contact with participants during plenary sessions.
- Prepare posters and/or b/w board with important messages to save time (e.g. aims of a particular session).
- Start in time each morning and stick to the agreed breaks. You can easily lose 10-15% of precious time if you don't keep an eye on your watch.
- Make sure that you have prepared and checked the handouts and presentations before you start the training session.

Advice on dealing with difficult questions

- With your fellow facilitator, note down any objections or questions which you think might be raised and discuss strategies for dealing with them.
- Play for time when confronted with a difficult question (e.g.by asking for the question to be rephrased, or by inviting participants' view).
- Don't get involved in disputes with individual participants.
- Don't allow participants to shout at each other.
- If there is a disruptive participant, make sure you find a busy role for him/her,
- especially in group work (e.g. where he/she could function as a secretary); then give positive feedback whenever you have an opportunity.
- Remember you are running the workshop; you should resist, quietly but firmly, any attempt to usurp your role.
- Have a quiet word with any awkward participant who doesn't calm down within a day. Find out what is bothering them and discuss it.
- Remember that this is only a first step in the long process of change for the participants. You should expect awkward questions and resistance. You can help as a facilitator by allowing participants to clear their doubts, by being patient and supportive, and by making provision for maximum opportunities to experience alternative methodologies and to consider their implications. Responsibility for change is theirs, not yours.
- Be prepared for negative feedback too. You may not see the fruits of your labour during the workshop itself. Participants will need time to reflect after the workshop and to try out the activities in their own classrooms.

Some Don'ts

- Don't try to force your views; it is better to admit that you don't know everything.
- Don't put down any participant or their contribution.
- Don't be sarcastic.
- Don't treat participants like students.
- Don't allow yourself to become defensive about the material.
- Don't criticize the materials, education system, policy and infrastructure publicly.
- Don't talk too much.
- Don't allow any participant to hijack a discussion.
- Don't take any criticism personally.
- Don't be too "driven" by the materials and remain open to positive changes.
- Don't allow local administrative demands and procedures to consume the time you need for the workshop.
- Don't interrupt pair/small group work once you have set it up–except to announce "two more minutes".

If you are working in a team of two facilitators

- Before the start of the programme, divide work equally for the next day, and write down what you agreed upon.
- Set aside a short time for review and planning each day; make it clear to participants that you need that time and that it is sacrosanct.
- Play to your individual strengths (e.g., one may be better at board writing, one may be better at talking to the whole group)
- Never disagree in public.
- Don't compete with each other or interrupt each other: if you are seen to listen carefully to each other and to respect each other, this will have a positive effect on the course participants.

- Give each other constructive feedback after sessions (this is a development opportunity for you); positive comments are as valuable as negative ones. Give feedback to each other on matters such as timing, voice, eye-contact, blackboard work etc. Remember to appreciate the good work of your co facilitator from time to time.
- When teachers are working in pairs or small groups, decide amicably who is to monitor which half of the group.
- Develop the habit of working briskly, and adhering to the time allocations for each activity.
- Master Trainers should be formally attired.

Note:

After the groups are formed, group leaders may be informed that they have to present a detailed report of the previous day on a daily basis. Since it is just a two-day workshop, two groups may be assigned the task of reporting for one day thus dividing the report into Pre and Post lunch sessions.

ICE-BREAKING AND INTRODUCTION + GROUP FORMATION

DURATION: 30 Minutes

OBJECTIVES: At the end of this activity, the participants will be able to:

- know each other and the facilitator
- compare the objectives of the programme with their expectations
- appreciate their role in making teaching and learning of Science joyful in their classrooms

METHODOLOGY:

Informal interaction with the Participants

STRATEGY:

1. Ask the participants to introduce themselves with a positive quality they possess, with the starting alphabet of their name, and to be honest about the positive attribute that they are introducing themselves with. For e.g. 'Hariram', may introduce himself as 'Honest Hariram', 'Priyanka' as 'Positive Priyanka', 'Rakesh' as 'Rocking Rakesh' etc.

This helps the course participants (CP) to pause and appreciate themselves and be aware of the plus points of others.

2. Ask the participants about the expectations from the workshop.
3. The facilitator writes down the expectations on the board
4. Explain the status of Science learning in our country and then states the objectives of the programme.

Notes for the Master Trainer

- The Ice- breaking session will set the tone of the workshop hence the Master Trainers need to plan how to get the CPs into a proactive mode.
- This should be done in a time bound manner
- The CPs should be grouped into groups of seven each with one group having 8 participants (if the approximate number is 50)
- The MTs can use the suggested ice breaking strategy or a similar one:

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TRAINING MODULE NO. 1

TARGET GROUP: KVS TGT SCIENCE TEACHERS

TOPIC: INTRODUCTION AND OVERVIEW OF PISA

DURATION: 60 Minutes

LEARNING OBJECTIVES/ OUTCOMES:

At the end of this session, the participants will be able to a clear idea of **:**

- What is PISA
- India's agreement with OECD
- Who will participate in PISA/Age group of students
- How will PISA help India?
- What is a Field Trial and what is a Main Survey?
- What are the three domains?
- How is the PISA test different and what will it achieve?

TRAINING MATERIAL/METHODOLOGY:

- ✓ Computer with Internet
- ✓ LCD projector
- ✓ White board and marker
- ✓ Power point presentation

MATERIALS REQUIRED: Soft Copy of the Presentation 1-Introduction to PISA (40 Slides)

TRAINING STRATEGY:

- Open session -discussion with the participants on what they know about PISA and its purpose– 10 minutes
- Presentation by the Facilitator on 'Introduction and overview of PISA with the help of the Power point presentation. 40 minutes
- Clarification of doubts and summing up. 10 minutes

TRAINING SETTINGS AND SEQUENCE:

- Training room with the training materials as listed above

EVALUATION: Oral questions

PISA

Programme for International Student Assessment

CAPACITY BUILDING WORKSHOP

Why PISA- how will it help India

PISA --- Competency Based Assessment

Measures the extent to which students have acquired key competencies --essential for full participation in modern societies.

Would lead to recognition and acceptability of Indian students and prepare them for the global economy in the 21st century

What is PISA

- **OECD's (Organisation for Economic Co-operation and Development) Programme for International Student Assessment**.
- **Triennial assessment** --tests skills and knowledge of 15-year-old students from all over the world in Reading, Mathematics & Science.
- Tests --- designed to gauge how well the students master key subjects in order to be **prepared for real-life situations in the adult world**
- http://www.oecd.org/pisa/

Why PISA- how will it help India

Learnings from participation in PISA will help to introduce competency based

examination reforms in the school system

Enhance effectiveness of education systems

Help move away from rote learning.

The CBSE and NCERT will be part of the process and activities leading to the actual test

India's Agreement with OECD

- **Prime Minister's approval --- 28th Jan 2019 --for signing of Agreement between Department of School Education & Literacy, MHRD & OECD for India's participation in PISA 2021**
- **Ex Post Facto approval by Cabinet --19th Feb 2019**
- **Schools run by Kendriya Vidyalaya Sangathan (KVS), Navodaya Vidyalaya Samiti (NVS) and schools in the UT of Chandigarh to participate.**

http://www.pib.nic.in/PressReleseDetail.aspx?PRID=1561704

Why choose 15-year-olds?

In most countries, at the age of 15, students can decide whether or not they want to continue their education

So they need to be equipped for adult life

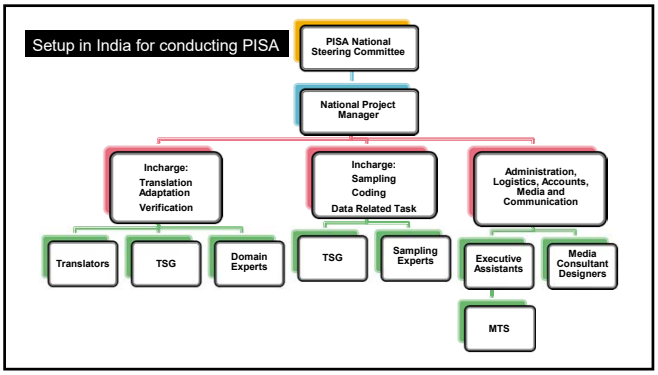
PISA publishes the results of the test a year after the students are tested to help governments shape their education policy.

Eligibility of Students

Children of age group 15 years 3 months – 16 years 2 months attending any educational institution in the country (selected region), including public, private, aided, international schools.

Open Schools students --- not eligible.

Students born between Jan 2005 to Feb 2006 as test will be held in April 2021



Field Trial (FT)

- To be conducted in April 2020.
- 25 schools and 36 students in each school i.e. 900 students to be assessed through 18 forms to be used for testing 50 students each.
- Exact dates to be chosen for field trial(Tentative – March-May 2020)

Additional Detail

India has opted for Paper Based Assessment

The instruments and questionnaires will be provided in Hindi as well as English and have opted for International verification of adapted and translated versions.

Chandigarh UT will be representing India for purpose of ranking.

KV and NV will be a national option and shall be treated as a single unit for reporting purpose.

PISA 2021
Officially called Main Survey

To be conducted in April 2021

5250 students (150 schools x 35 students) will be assessed on the following subjects:-

- ❖ Maths and Science (33% students)
- ❖ Maths and Reading (33% students)
- ❖ Reading and Science (33%students)

PISA---Principles of Testing

- ❖ Covers three domains: Reading Literacy, Mathematical Literacy And Scientific Literacy.
- ❖ PISA aims to define each domain not merely in terms of mastery of the school curriculum, but in terms of important knowledge and skills needed in adult life.
- ❖ Emphasis is placed on the mastery of processes, understanding of concepts and the ability to function in various situations within each domain.

https://www.acer.org/files/PISA_Thematic_Report_-_Maths_-_web.pdf
https://www.acer.org/files/PISA_Thematic_Report_-_Science_-_web.pdf
https://www.acer.org/files/PISA_Thematic_Report_-_Reading_-_web.pdf

Definition of Scientific literacy

The ability to engage with science-related issues and also with the ideas of science, as a reflective citizen.

A scientifically literate person is willing to engage in reasoned discourse about science and technology, which requires the competencies to:

- Explain phenomena scientifically
- Evaluate and design scientific enquiry
- Interpret data and evidence

Definition of Mathematical literacy

An individual's capacity to formulate, employ and interpret Mathematics in a variety of contexts.

It includes reasoning mathematically and using mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena.

https://www.acer.org/files/PISA_Thematic_Report_-_Science_-_web.pdf

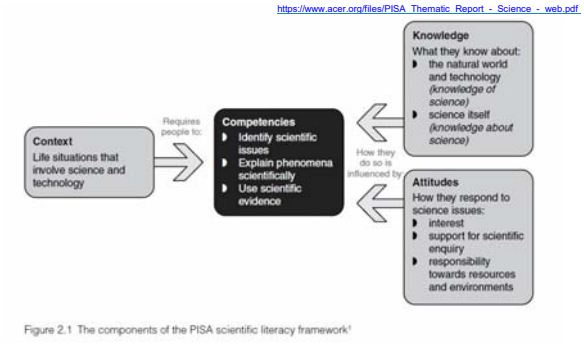
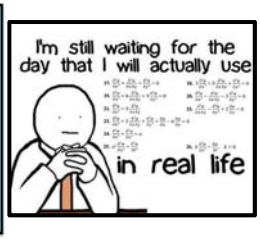


Figure 2.1 The components of the PISA scientific literacy framework[1]

Definition of Mathematical Literacy

It assists individuals to recognise the role that Mathematics plays in the world.

To make the well-founded judgments and decisions needed by constructive, engaged and reflective citizens



Definition of Reading literacy

An individual's capacity to

- ❖ understand
- ❖ use
- ❖ reflect on and engage with written texts

This will help the students

- ❖ to achieve goals
- ❖ to develop knowledge and potential
- ❖ to participate in society

Challenges, Problems and Issues

- ❖Why might **learners** find PISA difficult?
- ❖What skills did **you** need to answer the questions?

Challenges, Problems and Issues

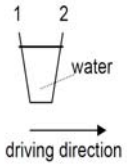
- Too much text/reading
- Too much information
- Learners don't know how to answer
- The questions are long and presented in unfamiliar layouts
- Learners don't understand the questions
- They give up too easily
- They are afraid to be wrong/Fear of failure

Question 1: BUSES *S127Q01*

A bus is driving along a straight stretch of road. The bus driver, named Ray, has a cup of water resting on the dashboard: Suddenly Ray has to slam on the brakes.

What is most likely to happen to the water in the cup?

A :The water will stay horizontal.
B :The water will spill over side 1.
C :The water will spill over side 2.
D :The water will spill but you cannot tell if it will spill at side 1 or side 2.



Anatomy of a PISA style Question

BUSES SCORING 1

QUESTION INTENT: **Process:** **Demonstrating knowledge and understanding**

Theme: **Forces and movement**

Area: **Science in Technology**

Full credit
Code 1: C. The water will spill over side 2.

No credit
Code 0: Other responses.
Code 9: Missing.

Science

https://www.acer.org/files/PISA_Thematic_Report_-_Science_-_web.pdf

Question 4: BUSES *S127Q04- 0 1 8 9*

Ray's bus is, like most buses, powered by a petrol engine. These buses contribute to environmental pollution.

- Some cities have trolley buses: they are powered by an electric engine.
- The voltage needed for such an electric engine is provided by overhead lines (like electric trains).
- The electricity is supplied by a power station

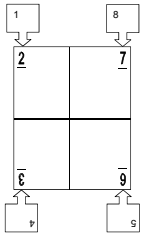
Mathematics

https://www.acer.org/files/PISA_Thematic_Report_-_Maths_-_web.pdf

Mathematics Scoring

Correct
Page numbers placed correctly in the following positions

(ignore the orientation of the numbers)



Mathematics Question- Making a booklet

Question 1: MAKING A BOOKLET M598Q01 - 019

Question intent: Space and shape

Figure 1 shows how to make a small booklet.

The instructions are given below:

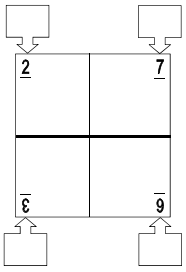
Take a piece of paper and fold it twice.
Staple edge *a*.
Cut open two edges at *b*.
The result is a small booklet with eight pages.

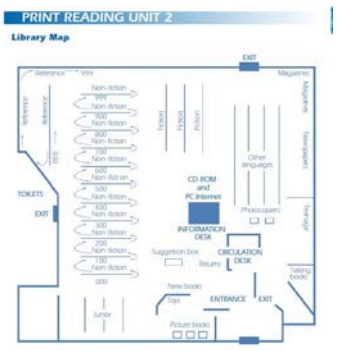
Figure 2 shows one side of a piece of paper that is used to make such a booklet.
The page numbers have been put on the paper in advance.
The thick line indicates where the paper will be cut after folding.

Reading

https://www.acer.org/files/PISA_Thematic_Report_-_Reading_-_web.pdf

Write the numbers 1, 4, 5 and 8 in the correct boxes in the following diagram to show which page number is directly behind each of the page numbers 2, 3, 6 and 7.

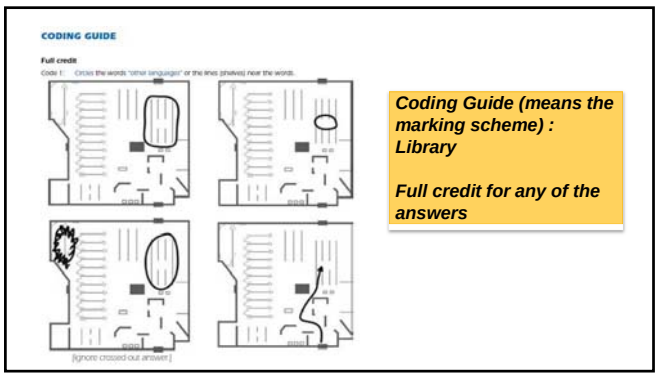




Question : Library

For school you need to read a novel in French.

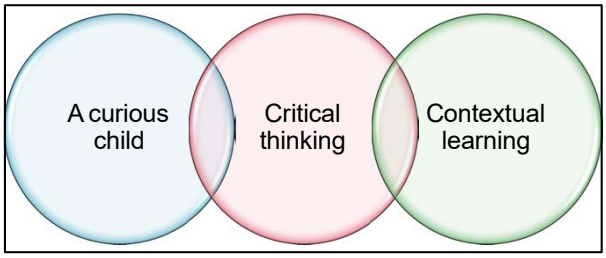
On the map draw a circle around the section where you would be most likely to find a suitable book to borrow.



Coding Guide (means the marking scheme) : Library

Full credit for any of the answers

What will it Achieve?



Question 7A: Library
Where are *New books located?*
A. In the fiction section.
B. In the non-fiction section.
C. Near the entrance.
D. Near the information desk.

Library scoring 7a
Note: The correct answer is C: "Near the entrance". This question is for information only and will not independently contribute to the student's score.
The answer is taken into account in assessing the response to Question 7B.

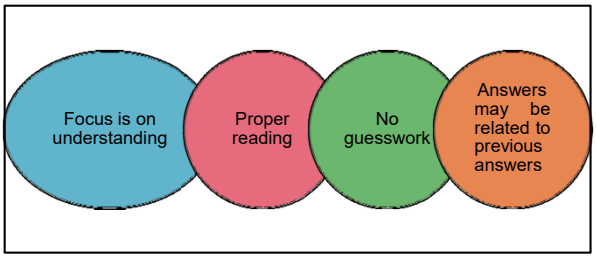
question 7B: Library
Explain why this location might have been chosen for *New books.*
.....

Induce Critical Thinking

Be happy- when children start asking questions like

- **Ice floats on water despite being a solid !!!**
- **So how does it affect nature?**
- **Marine life**

Thus PISA Test is Different



History – Thinking Differently

Dandi March by Gandhiji

World's Smartest Marketing Campaign !!

Daily Phenomenon

- **Both Earth and Moon are revolving and rotating**
- **So why do we always see the same side of MOON**

Resources

https://learning.gov.wales/resources/learningpacks/pisa/module-8/?lang=en#/resources/learningpacks/pisa/module-8/training-pack/?lang=en
https://learning.gov.wales/docs/learningwales/publications/120629pisabookleten.pdf
https://learning.gov.wales/docs/learningwales/publications/130429how-to-develop-thinking-en.pdf
https://learning.gov.wales/resources/learningpacks/pisa/Deconstructing-pisa-style-and-sample-questions/?lang=en#/resources/learningpacks/pisa/Deconstructing-pisa-style-and-sample-questions/training-pack/?lang=en
http://www.bcsea.bt/index.php/pisa-released-items/.
http://www.oecd.org/pisa/test/
http://www.oecd.org/pisa/
http://www.oecd.org/publications/ten-questions-for-mathematics-teachers-and-how-pisa-can-help-answer-them-9789264265387-en.htm
https://www.acer.org/files/PISA_Thematic_Report_-_Maths_-_web.pdf
https://www.acer.org/files/PISA_Thematic_Report_-_Science_-_web.pdf
https://www.acer.org/files/PISA_Thematic_Report_-_Reading_-_web.pdf
http://www.gov.pe.ca/photos/original/ed_PISA_read1.pdf

What can PISA Achieve?

- Children look forward to school
  - **They ask questions for which the text book does not have answers**
  - **Then they learn to explore and collaborate**

It is expected that PISA like tests will help in this area of child growth.

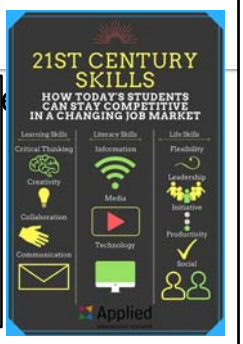
It will also make TEACHING very exciting !!!

Future of Students

Competenci

- **Critical thinking/Problem Solving**
- **Communication**
- **Collaboration**

Modern examinations like CAT, SAT, GRE, CSAT (UPSC), CLAT etc. are all adapting to this goal.



TRAINING MODULE NO. 2

TARGET GROUP: KVS TGT SCIENCE TEACHERS

TOPIC: THE DISCIPLINE OF SCIENCE

DURATION: 60 Minutes

LEARNING OBJECTIVES/ OUTCOMES:

At the end of this session, the participants will be able to

- ❖ to understand the branches of science and its processes.
- ❖ to develop scientific thinking and attitude towards discipline of science
- ❖ to acquire knowledge, conceptual understanding and skills to solve problems

TRAINING MATERIAL/METHODOLOGY:

- ✓ Computer with Internet
- ✓ LCD projector
- ✓ White board and marker
- ✓ Power point presentation

TRAINING STRATEGY:

- ❖ Open session on emerging branches of science – 10 minutes
- ❖ The Four stages of Evolution to develop scientific discipline through a power point presentation – 20 minutes
- ❖ Scientific discovery through a power point presentation – 20 minutes
- ❖ Open discussion on doubts raised by participants & Evaluation – 10 minutes

TRAINING SETTINGS AND SEQUENCE:

- Training room with the training materials as listed above

EVALUATION: Oral questions and Quiz

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT

PISA

1

DISCIPLINE OF SCIENCE

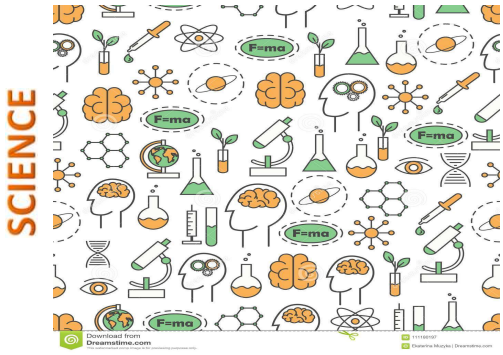
2

Science is the study of the nature and behaviour of natural things and the knowledge that we obtain about them.

3

Discipline is the field of study of a particular subject.

4



5

Why is teaching science so important?
Science is a huge part of our daily lives, from technology to transportation to medicine to legal issues and government decisions.

The pace of research and discovery is quickly accelerating.

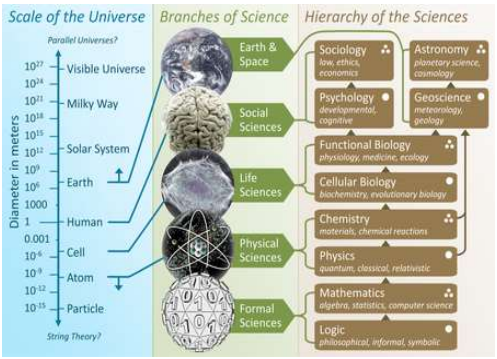
That makes it more important than ever to understand science, for in doing so, students can better understand the world.

6

Teaching science requires critical thinking, effective communication, collaboration and creativity.
Real-life scenarios, peer-to-peer teaching, hands-on activities, science projects and field research journals are effective teaching techniques in the science curricula.

Instruction in science often can foster greater interpersonal skills and independent thought.

7



8

•**Formal sciences**: the study of mathematics, logic, and statistics,
•**Natural sciences**: the study of natural phenomena
•(including cosmological, geological, physical, chemical, and biological factors of the universe).
•Natural science can be divided into two main branches:

9

•**physical science** and **life science** (or biological science).
•**Social sciences**: the study of human behaviour and societies

10

Natural and Social sciences are empirical sciences, Meaning that the knowledge must be based on observable phenomena and must be capable of being verified by other researchers, working under the same conditions

11

Evolution of a scientific discipline

Stage 1. The introduction of new objects / phenomena, with an accompanying language to adequately describe such phenomena.

12

Stage 2. Development of a 'tool- box' of methods /techniques to probe the objects /phenomena; with advancements in methodologies helping to identify and understand the degree to which other phenomena
fall into the realm of this new science

13

Stage 3. The stage at which most of the specific knowledge is generated, with the majority of research publications being published, often focusing on the application of new research methods to objects / phenomena.
Scientists may re-describe their subject matter using refinements from stage 2,
Contd.

14

Contd.
in the same way that with the advent of molecular biology, biologists might re-describe old subject matter from this new context; thus creating new insights, new answers and new questions.

15

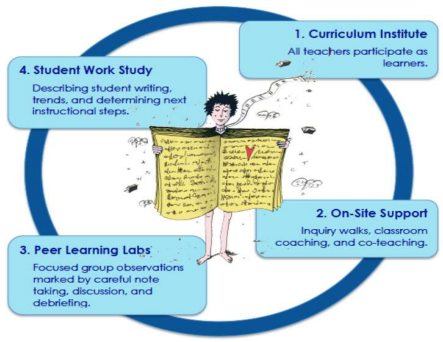
Stage 4. A seeming steady-state for a discipline, where the knowledge gained from earlier stages is maintained and passed on, often with practical application; often with new means generated to present the information. Whilst ground-breaking new discoveries are not necessarily made, this does not preclude crucial revisions to the role of this discipline within scientific environment.

16

Five Teaching techniques

- Real-life scenarios that involve case studies
- Ways of analyzing current problems
- Peer-to-peer teaching, which involves students in their own education
- Hands-on activities that engage students beyond the lecture
- Teach useful scientific concepts

17



18

Scientific Discovery, Computational Models of Scientific Discovery

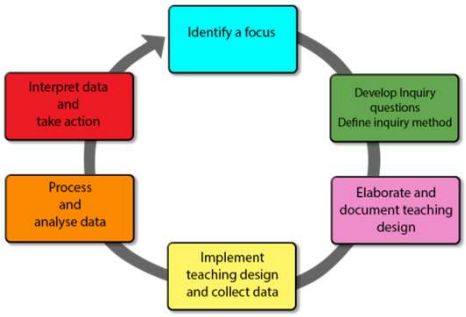
Scientific discovery is the process by which novel, empirically valid, general, and rational knowledge about phenomena is created. Computational models of scientific discovery are computer programs that make discoveries

19

Science projects, which teach the scientific methods of inquiry and experiment.

Field research journals

20



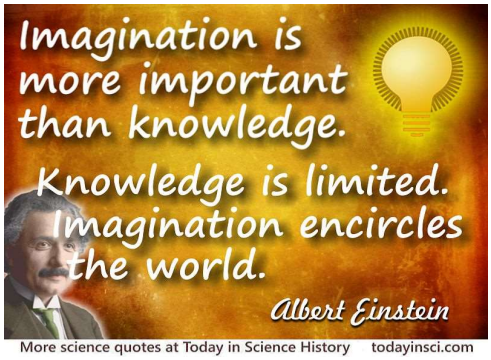
21

Model discoveries from the history of science or simulate the behaviour of participants/Students solving scientific problems

22

The success of these models provides some insights into the nature of human cognitive processes in scientific discovery and addresses some interesting issues about the nature of scientific discovery itself

23



24

TRAINING MODULE: 3

REVIEW OF THE PISA'S SCIENCE LITERACY FRAMEWORK

TARGET GROUP: TGT SCIENCE_ KVS

DURATION: 60 MINUTES

SESSION: ONE

TOPIC: REVIEW OF THE PISA'S SCIENCE LITERACY FRAMEWORK

LEARNING OBJECTIVES / OUTCOMES:

At the end of this session, the participants will be able to understand

i. the concept of Scientific Literacy

ii. PISA 's Science Literacy Framework

TRAINING MATERIALS / METHODOLOGY:

- Computer and LCD Projector
- White board, marker and duster
- Power point Presentation

TRAINING STRATEGY:

Open Session with discussion on Science Literacy and its components (15 minutes)

- Introduction to the PISA's Science Literacy Framework (35 minutes)
- Open forum to answer any question that may be asked by the trainee. (10 Minutes)

TRAINING SETTING AND SEQUENCE:

- Classroom with the required training materials as listed above.

REFERENCE

1.) www.gov.pe.ca/photos/original/ed_PISA_scienc1.pdf

2.) https://www.oecd.org/pisa/pisaproducts/Draft%20PISA%202015%20Science%20Framework%20.pdf

3.) https://link.springer.com/chapter/10.1007/978-94-007-4458-5_1

4.) https://www.dcu.ie/sites/default/files/smec/pdfs/11B%20Ruth%20Chadwick%20Teaching%20and%20assessing%20socio-scientific%20research%20in%20pre-service%20teacher%20

5.) www.oecd.org/pisa/pisa-for-development/PISA-D-Assessment-and-Analytical-Framework-Ebook.pdf

EVALUATION:

1. How is Scientific Literacy defined?
2. What is the need for Scientific Literacy in 21st Century student?
3. How do you think a teacher can help the student in inculcating Scientific Literacy?

****

OECD
PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT (PISA)

PISA'S SCIENCE LITERACY FRAMEWORK

DAY : 1

SESSION : 3

1

WHAT IS SCIENTIFIC LITERACY?

Scientific Literacy - "The capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity."

2

SCIENTIFIC LITERACY MEANS:

✓ that a person can ask, find or determine answers to questions derived from curiosity about everyday experiences.
✓ that a person can describe, explain and predict natural phenomena.
✓ being able to read with understanding, articles about science in the popular press and to engage in social conversation about the validity of the conclusions.

3

SCIENTIFIC LITERACY MEANS:

✓ that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed.
✓ being able to evaluate the quality of scientific information based on its source and the methods used to generate it.
✓ the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.

(National Science Education Standards, page 22)

4

SCIENTIFICALLY LITERATE STUDENTS HAVE A SET OF BASIC SKILLS THAT ALLOW THEM TO:

- Access the scientific information they need when confronting a real-world problem or question.
- Critique claims that they utilize scientific evidence to reconcile conflicting claims about scientific evidence.
- Understand human factors that influence the creation, interpretation, and communication of scientific evidence; and
- Integrate thinking scientifically about a question with knowledge from other fields.

http://scienceliteracy.bard.edu

5

WHY MUST SCIENTIFIC LITERACY BE CULTIVATED

One question that each Science teacher needs to ask within is -- What should my students know about science by the time they graduate from school?

They should certainly be **Scientifically literate**.

6

After PISA 2006, science was the focus domain (major domain) for the second time in PISA 2015.

7

Programme for International Student Assessment (PISA)

- Created in 1997 by OECD
- Aim: to monitor outcomes of educational systems in terms of student achievement
- Age: 15 years

8

Programme for International Student Assessment (PISA)

Surveys every 3 years since 2000 in reading, mathematical and scientific literacy

- 2000 **reading**, maths, science
- 2003 reading, **maths**, science
- 2006 reading, maths, **science**
- 2009 **reading**, maths, science
- 2012 reading, **maths**, science
- 2015 reading, maths, **science**
- 2018 **reading,** maths, science
- **2021** reading**, maths**, science

9

Why comparing countries in science and mathematics education?

- Economic importance of science and mathematics education
- Internationalization: mobility of students
- Tool for educational policy: monitoring, reform
- Learning from other systems: relative strengths and weaknesses

10

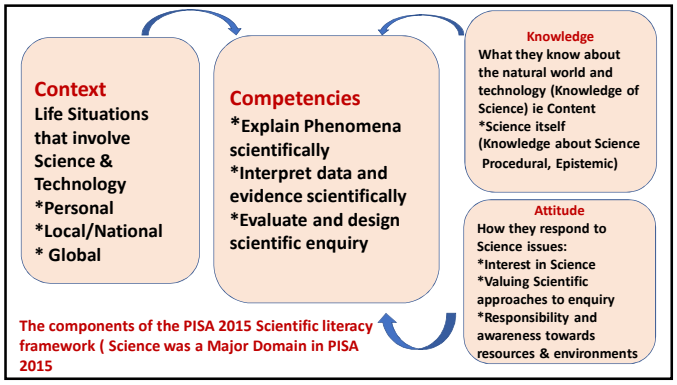
FOCUS OF PISA

- Collaborative effort: OECD + non-member partner economies
- To measure how well students at age 15 are prepared to meet challenges in future life
- Beyond school-based approach: use of knowledge in everyday tasks and challenges
- Based on model of lifelong learning
- Not only assessing knowledge: also how to apply knowledge in real-life issues

11

PISA's scientific exercises cover important concepts in physics, chemistry, biology and geosciences. In doing so, the PISA study examines the extent to which young people are scientifically literate when they complete their compulsory schooling.

12



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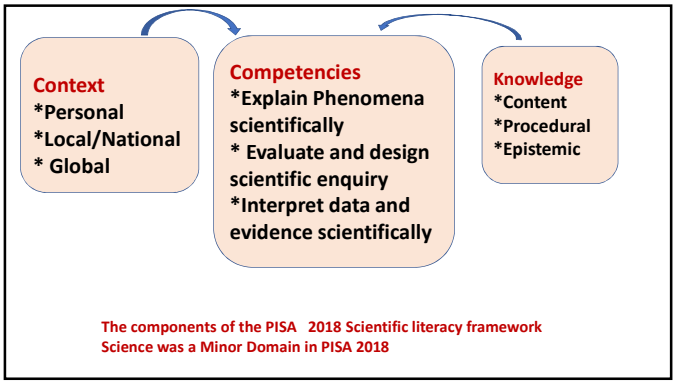

14

The conceptual framework defines five contexts, each of which may have a personal, social or global reference:

- health and disease
- natural resources
- environment quality
- hazards
- the frontiers of science and technology

15

SCIENTIFIC KNOWLEDGE:

Knowledge of science: i.e.Content Knowledge about
- Physical systems
- Living systems
- Earth and space systems

Knowledge about science:
- Procedural knowledge: variables, measurement, replicability, representing data, control of variables
- Epistemic knowledge: purposes, nature, values, justification, errors, collaboration and critique. (In other words Knowledge Construction)

16

THE 2015/ 2018 PISA DEFINITION OF SCIENTIFIC LITERACY?

*A Scientifically literate person, therefore is willing to engage in reasoned discourse about Science and technology which requires the **competencies** of:*

1. ***Explaining phenomena scientifically***
2. ***Evaluating and designing scientific enquiry***
3. ***Interpreting data and evidence scientifically***

17

HOW IS SCIENTIFIC LITERACY MEASURED IN PISA?

The scientific literacy framework comprises four interrelated aspects:

- ✓ the **contexts** in which tasks are embedded
- ✓ the **competencies** that students need to apply
- ✓ the **knowledge domains** involved and
- ✓ **students' attitudes** towards science

18

Table 4.2. Contexts for the PISA 2018 scientific literacy assessment

	Personal	Local/National	Global
Health and disease	Maintenance of health, accidents, nutrition	Control of disease, food choices, community health	Epidemics, spread of infectious diseases
Natural resources	Personal consumption of materials and energy	Maintenance of human populations, quality of life, security, production and distribution of food, energy supply	Renewable and non-renewable natural systems, population growth, sustainable use of species
Environmental quality	Environmentally friendly actions, use and disposal of materials and devices	Population distribution, disposal of waste, environmental impact	Biodiversity, ecological sustainability, control of pollution, production and loss of soil/biomass
Hazards	Risk assessments of lifestyle choices	Rapid changes (e.g., earthquakes, severe weather), slow and progressive changes (e.g., coastal erosion, sedimentation), risk assessment	Climate change, impact of modern communication
Frontiers of science and technology	Scientific aspects of hobbies, personal technology, music and sporting activities	New materials, devices and processes, genetic modifications, health technology, transport	Extinction of species, exploration of space, origin and structure of the Universe

19

- PISA 2018 assessed scientific knowledge using contexts that raised pertinent issues that were often relevant to the science education curricula of participating countries. However, assessment items were not limited to school science contexts.

20

- Items in the PISA 2018 science assessment related to the **self, family and peer groups (personal), to the community (local and national) or to life across the world (global).**
- The context may have involved technology or in some cases, a historical element that may have been used to assess students' understanding of the processes and practices involved in advancing scientific knowledge.

21

The PISA science assessment, assesses competencies and knowledge in specific contexts.

22

SCIENTIFIC LITERACY FRAMEWORK

A framework for mapping items against the two dimensions of **knowledge** and **competencies**. In addition, each item can also be mapped using a third dimension based on a **depth of knowledge (DoK) taxonomy.**

		Competencies			DOK		
		Explain Phenomena scientifically	Evaluate and design scientific enquiry	Interpret data and evidence scientifically	Low	Medium	High
Knowledge	Content Knowledge						
	Procedural Knowledge						
	Epistemic Knowledge						

23

SCIENTIFIC LITERACY—LEVELS

Levels – Depth of Knowledge Taxonomy
Low (L)
Medium (M)
High (H)

24

SUGGESTIONS FOR TEACHING

- Engage your students in each task in the document as a whole-class discussion or by asking students to attempt a task and then discussing it afterward with them.
- Scoring criteria used by the PISA markers to score the actual assessment are provided. Examine the criteria and review the acceptable answers with your students.
- Use the tasks when planning a unit of work on a specific topic in the curriculum. Try to incorporate the tasks into your instructional and assessment plans.
- Remind students that partial marks are given for partially correct answers and encourage them to take the assessment seriously and strive for excellence.
- Discussion on incorrect answers can open up new areas for conceptual understanding

25

Teachers' pedagogical strategies must center around hands-on, realistic, problem-solving situations.
We need to give students repeated opportunities to:

- Respond to real-world problems,
- Explore solutions to problems about which there is conflicting scientific evidence,
- Practice transferring their skills and knowledge from one context to another.
- If students can transfer skills and knowledge from one context to another in the classroom, they will certainly be able to replicate this challenge outside the boundaries of the classroom in the real-world situations.

26

PISA TESTS IN SCHOOLS

- Selection of schools
- School coordinator appointed
- Random selection of 35 ;15year olds per school
- Permission from parents
- Tests session organized by test administrator
- 13 different booklets with sets of questions
- 2 hours for knowledge testing of students
- 30 minutes for student questionnaire: personal background, learning habits, attitudes, motivation
- School questionnaire (headmaster): demographic characteristics, quality of the learning environment

27

PISA-SOURCES

- http://www.pisa.oecd.org/
- http://www.oecd.org/pisa/pisaproducts/

28

Thank you!

29

TRAINING MODULE: 4 & 5

BROADENING HORIZONS OF SCIENCE LEARNING_I & II

TARGET GROUP: TGT SCIENCE KVS

NUMBER OF SESSIONS: TWO

DURATION: 60 MINUTES EACH

SESSION: ONE &TWO

TOPIC: BROADENING HORIZONS OF SCIENCE LEARNING_I & II

LEARNING OBJECTIVES / OUTCOMES:

At the end of this session, the participants will be able to

i. review the need of a Historical perspective for teaching Science
ii. recognize the benefits of reading, as essential for Science learning.
iii. appreciate the Constructivist approach to learning Science.

TRAINING MATERIALS / METHODOLOGY:

- Computer and LCD Projector
- White board, marker and duster
- Power point Presentation

TRAINING STRATEGY:

- Historical Perspective for teaching Science (30 minutes)
- Review the benefits of reading for Science learning (30 Minutes)
- Constructivism and its components (45 minutes)
- Open forum to answer any question that may be asked by the trainee. (15 Minutes)

TRAINING SETTING AND SEQUENCE:

- Classroom with the required training materials as listed above.

EVALUATION:

1. Narrate any interesting anecdote of a Scientist.
2. List any two benefits of fluency on reading and interpreting Scientific research papers
3. Design a simple lesson with Constructivist approach.

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5.) https://www.enchantedlearning.com/inventors/science.shtml

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7.) https://en.wikipedia.org/wiki/History_of_science

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9.) https://www.selfdevelopmentsecrets.com/benefits-importance-reading-books/

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11.) pages.vassar.edu/teachingtales/2013/06/04/the-importance-of-science-in-our-education/

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Broadening Horizons of Science Learning I

Historical Perspective for teaching Science

Benefits of Reading for Science Learning

Day :1

Session: IV

1

The need of Historical Perspective for Teaching Science

2

Why Study History for Science?

Self-improvement – of ourselves as scientists and as humans:

Efficiency

Perspective

Imagination

Education and public understanding of science

3

Science must recall and understand past failures and past successes in order to build on the latter and avoid repeating the former.

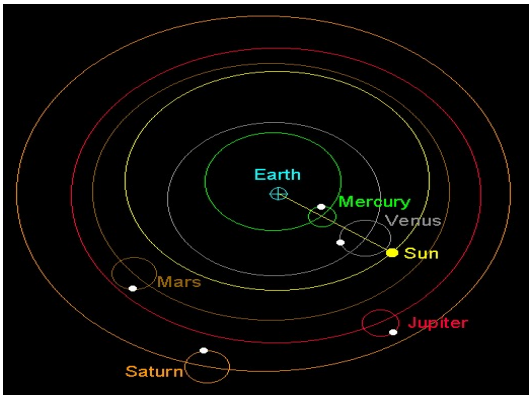
Ecology needs evolutionary history, genetics needs developmental history, and science needs history of science to recognize and benefit from past constraints and opportunities in various ways.

4

Ptolemy

- Created a Geocentric model of the universe.
- This worked well for a long time – especially for planets. But, eventually, errors would be detected (once Maths & technology developed more).Thus one notes that Science is constantly changing!

5



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Fossils – "figured stones" . . . for some time people considered these evidence of God's "playful" nature . . . that he had decorated some rocks to as replicas of living things.

7

Sequence of Fossil types

- By the 1830's there was general recognition that fossils had been organisms.
- Further, it was apparent that older strata contained very simple animals. As one moved through time, the organisms became more and more complex.
- There was no reason to believe that catastrophes had occurred . . . .

8

Existence of Rudimentary Organs

- By the late 1700s, biologists recognized that some animals retained parts they didn't use
  - snakes with vestiges of limbs
  - Flightless insects retained stunted wings.
  - These observations contradicted the argument from design theory.

9

Artificial Selection

- Animal breeders had demonstrated that species are not immutable . . . That is, they can be changed through selective breeding.

10

BENEFITS OF READING FOR SCIENCE LEARNING :

To prevent reading failure, educators must understand and act on scientific evidence.

11

Understanding Scientific Evidence

Scientific evidence must become a fundamental part of teaching. However, jargon and a lack of clear guidance make it difficult for educators to develop a good understanding of the term ***scientific evidence***.

12

The sheer number of youngsters who fail to learn to read—particularly those from impoverished backgrounds—underscores **the fact that children do not acquire reading ability naturally, easily, or incidentally.** For many children, learning to read is a monumental task that requires years of effort.

13

As Moats (1999) points out, **because of the complexity of learning to read, teaching reading is clearly a job for an expert; in fact, she compares it to rocket science.** Given that reading instruction requires substantial expertise, what does the expert teacher need to know?

14

At a minimum, teachers and administrators should be able to answer the following two questions.

How Does Reading Develop?

How Can We Prevent Reading Failure?

15

To get students to enjoy reading / Science

- Subject matter must be connected to students lives, innate curiosity, interests and culture.
- They must be involved in solving or designing solutions to multi-dimensional real-world problems.
- Provide multi-dimensional opportunities to succeed.
- Values driven by knowledge and skills, more than grades or scores.
- Celebrated and rewarded, when reading / learning skills are achieved.
- Science for all students – not organized only for the gifted

16

What To Teach In Science

- The big picture should not be compromised to accommodate testable details
- Taught as a social enterprise with philosophical, logical, cultural and geographical relevance.
- A series of life stories to inform real life impacts
- Practical work provides good context for learning
- Examples should fit culture
- A clear distinction made between science and technology, but relationships emphasized.

17

Justifications for Teaching Science to Everyone

- Science brings news for us:
  - unexpected things about ourselves, the world and the universe.
  - provides knowledge for everyday actions, for example, to cure and prevent diseases, keep order, shop wisely etc.
  - confirms as fact what appears counter intuitive to common sense.
  - Must be taught not routinely acquired.
  - Allows an intellectual base for communication.

18

New Knowledge Economy Demands

Skills of a practical and intellectual (cognitive) nature:

- Problem solving
- Literacy
- Numeracy
- Creativity
- Critical thinking
- Analyzing
- Estimating
- Computing
- Evaluating

Language
Interactivity
Cooperation
Patience
Proper values and attitudes
Personal motivation
Honesty
Respect
Ethics

19

Science Is A Continuing Success Story

There are limits to science but science works:

- helps to judge between expert advice and misinformation.
- science affect lives – no middle ground.
- scientific knowledge although universal must have local components and be renewed.
- Every person and country has responsibility and must be given opportunity
- Success must be followed and applied.

20

Three Metaphors of Learning

1) Learning is making sense of experiences

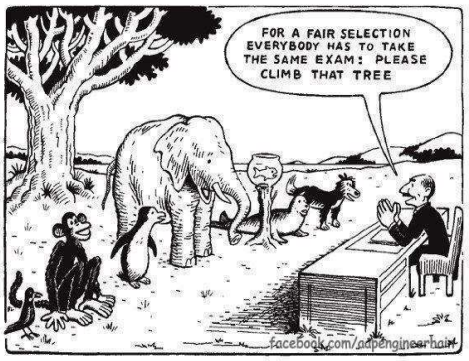
2) Learning is an exercise in meaning making

3) Learning is Knowledge Construction

21

Science Behind this event??

22



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THANK YOU!

24

Broadening Horizons of Science Learning II

Constructivism

Day :1
Session: V

1

Perspective of NCF 2005

The NCF was framed Considering the articulated ideas in the past such as

- to shift learning from rote method .
- to connect knowledge to life outside the school.
- to integrate examination into classroom learning and make it more flexible.
- to enriching the curriculum so that it goes beyond textbooks.
- to nurture an over-riding identity informed by caring concerns within the democratic polity of the country.

2

Science Education:

At the upper primary stage (Classes VI to VIII) the child should be engaged in :

- learning the principles of science through familiar experiences,
- working with hands to design simple technological units and modules (e.g. designing and making a working model of a windmill to lift weights) and
- continuing to learn more about the environment and health, including reproductive and sexual health, through activities and surveys.

3

At the upper primary stage (Classes VI to VIII) the child should be engaged in : contd

- Scientific concepts are to be arrived at mainly from activities and experiments.
- Science content at this stage is not to be regarded as a diluted version of secondary school science.
- Group activities, discussions with peers and teachers, surveys, organization of data and their display through exhibitions, etc. in schools and the neighbourhood should be important components of pedagogy.

4

At the secondary stage (Classes IX & X),

- students should be engaged in learning science as a composite discipline in working with hands and tools to design more advanced technological modules than at the upper primary stage and in activities and analyses on issues concerning the environment and health, including reproductive and sexual health.
- Systematic experimentation as a tool to discover/verify theoretical principles and working on locally significant projects involving science and technology are to be important parts of the curriculum at this stage.

5

Three main aspects in the PISA Scientific Literacy Framework

1. Content Knowledge	
Knowledge of science	**Knowledge about science**
Physical systems: Structure of matter; Properties of matter; Chemical changes of matter; Motions and forces; Energy and its transformation; Interactions of energy and matter	**Scientific inquiry:** the central process of science and the various components of that process.
Living systems: Cells; Humans; Populations; Ecosystems; Biosphere	**Scientific explanations:** the results of scientific enquiry.
Earth and space systems: Structures of Earth systems; Energy in Earth systems; Change in Earth systems; Earth's history Earth in space	
Technology systems: Role of science-based technology; Relationships between science and technology; Concepts; Important principles	

6

2. Competences
Identify scientific issues includes planning of inquiry activities and collection of data. Identifying verbs such as observe, experiment, inquiry, investigate
Draw evidence-based conclusions includes the use of textual, pictorial or table information in drawing conclusions. Identifying verbs such as interpret, explain, discuss, make, formulate
Explain scientific phenomena include applying knowledge of science or knowledge about science in a given situation. Identifying verbs such as apply, use, describe, solve

7

3. Contexts (personal, social, and global)
Health: maintenance of health, accidents, nutrition, epidemics, spread of infectious diseases
Natural resources: populations, quality of life, security, renewable and non-renewable energy sources, natural systems
Environmental quality: population distribution, disposal of waste, environmental impact, local weather, biodiversity, ecological sustainability, control of pollution
Hazards: rapid changes, climate change, impact of modern warfare

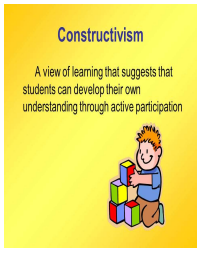
8

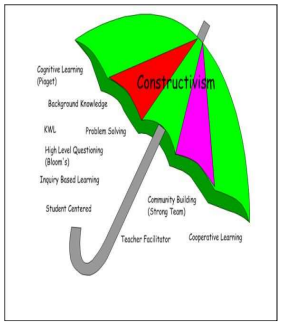
Definition of Learning

Learning is an active process in which learners construct their own meaning based on prior knowledge and experience.

9

Teaching & Learning of Science from the Perspective of **Constructivism**





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What is the history of constructivism, and how has it changed over time?

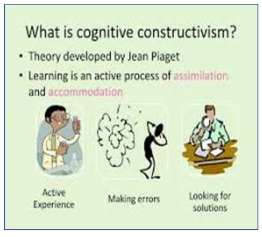
"As long as there were people asking each other questions, we have had constructivist classrooms. Constructivism, the study of learning, is about how we all make sense of our world, and that really hasn't changed."

— Jacqueline Grennan Brooks (1999)
CONCEPT TO CLASSROOM INTERVIEW

11

Types of Constructivism

1. Cognitive Constructivism (Individual)



2. Social Constructivism

12

Some of the Pioneers of Constructivism in Education

1) Cognitive Constructivism

To name a few

- **Jean Piaget (1896-1980)**

Piaget focused on how humans make meaning in relation to the interaction between their experiences and their ideas.

- **John Dewey (1895-1952)** education depends on experience

13

Some of the Pioneers of Constructivism in Education

1) Cognitive Constructivism

- **Jerome Seymour Bruner (1915–2016)** significant contributions to human cognitive psychology and cognitive learning theory in educational psychology
- **Ernst von Glasersfeld (1917–2010)** developed his model of radical constructivism (the art of teaching has little to do with the traffic of knowledge, its fundamental purpose must be to foster the art of Learning)
- **David Ausubel (1918-1962)** who first introduced his Assimilation Learning Theory in 1962. Ausubel's theory primarily explains **cognitive learning** – with the central idea being that learning occurs through the assimilation of new concepts into existing concept frameworks held by the learner

14

Jean Piaget and **John Dewey** developed theories of childhood development and education, what we now call **Progressive Education**, that led to the evolution of constructivism.

15

Piaget believed that humans learn through the construction of one logical structure after another. He also concluded that the logic of children and their modes of thinking are initially entirely different from those of adults. The implications of this theory and how he applied them have shaped the foundation for constructivist education.

16

Dewey called for education to be grounded in real experience. He wrote, **"If you have doubts about how learning happens, engage in sustained inquiry: study, ponder, consider alternative possibilities and arrive at your belief grounded in evidence."** Inquiry is a key part of constructivist learning.

17

Jerome Bruner

"To instruct someone... is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process not a product."

18

2. Social Constructivism

- **Lev Vygotsky** introduced the social aspect of learning into constructivism. He defined the "zone of proximal learning," according to which students solve problems beyond their actual developmental level (but within their level of potential development) under adult guidance or in collaboration with more capable peers.

19

- Among the educators, philosophers, psychologists, and sociologists who have added new perspectives to constructivist learning theory and practice are
- **Lev Vygotsky**

20

Seymour Papert's

- groundbreaking work in using computers to teach children has led to the widespread use of computer and information technology in constructivist environments.

Modern educators who have studied, written about, and practiced constructivist approaches to education include **John D. Bransford**, **Ernst von Glasersfeld**, **Eleanor Duckworth**, **George Forman**, **Roger Schank**, **Jacqueline Grennon Brooks** and **Martin G. Brooks** to name some.

21

Role of Prior Knowledge

22

Prior Knowledge

- **Schema** (In **psychology** and cognitive science, a **schema** describes a pattern of thought or behaviour that organizes categories of information and the relationships among them. ... People use **schemat/a** to organize current knowledge and provide a framework for future understanding.)
- **Draw a house!**
- **Draw a scenery**
- **Personal theories**
- **Interpretations**

23

Houses

24

25

2 Learning Theories: Knowledge

Cognitive Constructivism *Piaget*	**Social Constructivism** *Vygotsky*
Building on your existing knowledge by discovering and exploring new knowledge.	Knowledge is socially constructed.

26

2 Learning Theories: Learning

Cognitive Constructivism	**Social Constructivism**
Active assimilation and accommodation of new information to existing cognitive structures. Discovery by learners.	Integration of students into Knowledge community. Collaborative assimilation and accommodation of new information.

27

ASSIMILATION VS. ACCOMMODATION

- With preexisting mental structures (schema)
- No restructuring - overall beliefs and understanding of the world do not change as a result of the new information
- Add or combine new knowledge to own schema (existing mental structure)

- No preexisting mental structure
- With restructuring - tried something but did not get expected reaction
- Change own belief or schemas to "accommodate" the new information or knowledge

- assimilation and accommodation are related
- both serve as means to achieve the state of equilibration
- interpret and alter external reality to fit into internal mental structures until a state of equilibrium is achieved

Development

28

2 Learning Theories: Motivation

Cognitive Constructivism	**Social Constructivism**
Intrinsic. Learners set their own goals and motivate themselves to learn.	Intrinsic and extrinsic. Learning goals and motives are determined both by learners and extrinsic rewards provided by the Knowledge community.

29

2 Learning Theories: Instruction

Cognitive Constructivism	**Social Constructivism**
The teacher facilitates learning by providing an environment that promotes discovery and assimilation & accommodation.	Collaborative learning is facilitated and guided by the teacher. Dialogue and interactivity with others.

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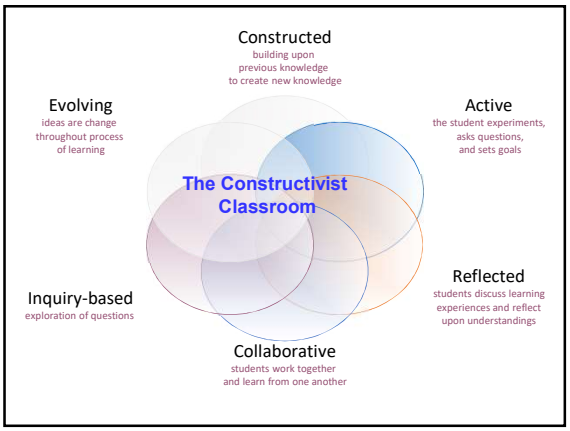

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Promoting Change

1. Identify existing misconceptions *before* instruction begins.
2. Convince students that their existing beliefs are inadequate.
3. Motivate students to learn correct explanations.
4. Monitor what students say and write for persistent misconceptions.

32

Implications

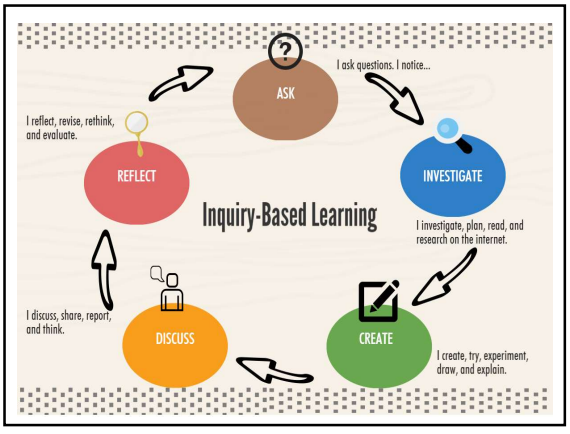
- Children should be provided with study materials, activities, and tools that are matched to and capitalize on their developing cognitive capabilities

33

Implications

- Present others' ideas
- Emphasize conceptual understanding
- Promote dialogue
- Create a community of learners

34



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Inquiry Based Learning: 5E's Learning Cycle

- Engage
- Explore
- Explain
- Elaborate
- Evaluate

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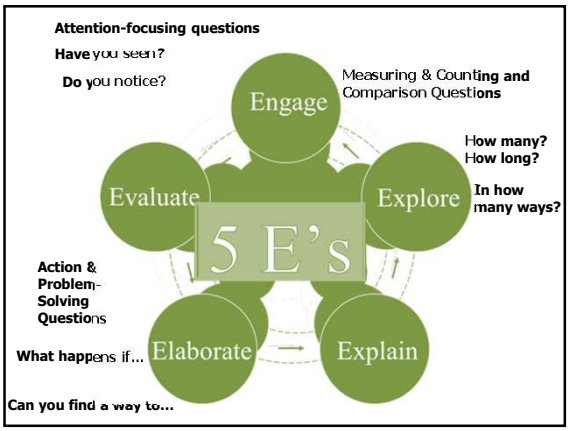

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THANK YOU!

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TRAINING MODULE NO. 6

TARGET GROUP: KVS TGT SCIENCE TEACHERS

TOPIC: KNOWLEDGE OF SCIENCE AND THE KNOWLEDGE ABOUT SCIENCE

DURATION: 60 Minutes

LEARNING OBJECTIVES/ OUTCOMES:

At the end of the session

The participants will be able:

- to develop scientific competencies
- to explain phenomena scientifically
- to interpret data and evidence scientifically
- to evaluate and design scientific enquiry

TRAINING MATERIAL/METHODOLOGY:

- ✓ Computer with Internet
- ✓ LCD projector
- ✓ White board and marker
- ✓ Power point presentation

TRAINING STRATEGY:

- ❖ Open session on knowledge of science – 10 minutes
- ❖ Different methods of teaching science in PISA through a power point presentation – 20 minutes
- ❖ Scientific inquiry and project-based learning through demonstration of activity – 20 minutes
- ❖ Open discussion on doubts raised by participants & Evaluation – 10 minutes

TRAINING SETTINGS AND SEQUENCE:

- Training room with the training materials as listed above

EVALUATION: Oral questions and Quiz

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT

PISA

SESSION : 3

KNOWLEDGE OF SCIENCE

&

KNOWLEDGE ABOUT SCIENCE

1

2

KNOWLEDGE OF SCIENCE

1. PHYSICAL SCIENCES
2. LIFE SCIENCES
3. EARTH SCIENCES

3

Competencies required for scientific literacy:

- Competency 1: Explain phenomena scientifically
- Competency 2: Interpret data and evidence scientifically
- Competency3:Evaluate and design scientific enquiry

4

KNOWLEDGE ABOUT SCIENCE

1. PROCEDURAL KNOWLEDGE
2. EPISTEMIC KNOWLEDGE

5

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

6

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.

7

CREATIVITY:

SCIENTISTS ARE CREATIVE AS THEY GENERATE EXPLANATIONS OF EVIDENCE.
DATA DOES NOT INTERPRET ITSELF.

8

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

9

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

10

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

11

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

12

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.

13

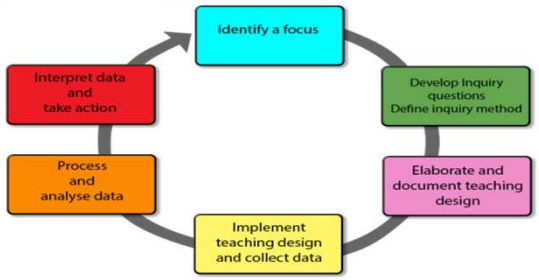
OBSERVATIONS VS INFERENCES :

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

14

EMPERICALLY BASED

SCIENTIFIC KNOWLEDGE IS BASED ON EVIDENCE



15

KNOWLEDGE ABOUT SCIENTIFIC INQUIRY

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

TEST A HYPOTHESIS

16

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

17

•ALL SCIENTISTS PERFORMING THE SAME PROCEDURES MAY NOT GET THE SAME RESULT

• INQUIRY PROCEDURES CAN INFLUENCE THE RESULT

18

•RESEARCH CONCLUSIONS MUST BE CONSTANT WITH THE DATA COLLECTED

•SCIENTIFIC DATA ARE NOT THE SAME OF THE SCIENTIFIC EVIDENCE

19

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

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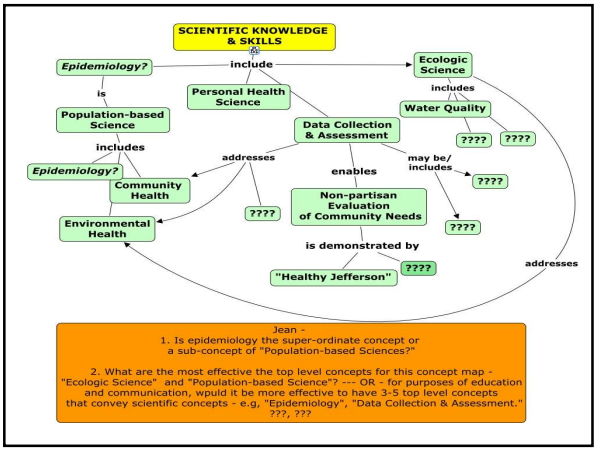

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Indigenous Knowledge	Scientific Knowledge
assumed to be the truth	assumed to be a best approximation
sacred and secular together	secular only
teaching through storytelling	didactic
learning by doing and experiencing	learning by formal education
oral 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

22

LAW 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-SUBSTANTAINED AND HAVE MUCH EVIDENCE TO SUPPORT THEM.

23

TEACHER-CENTRED METHODS

LEARNER -CENTRED METHODS

24

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.

25

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.

26

•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 to 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.

27

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.**

28

PROJECT METHOD
PRINCIPLES OF PROJECT METHOD
- 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.

29

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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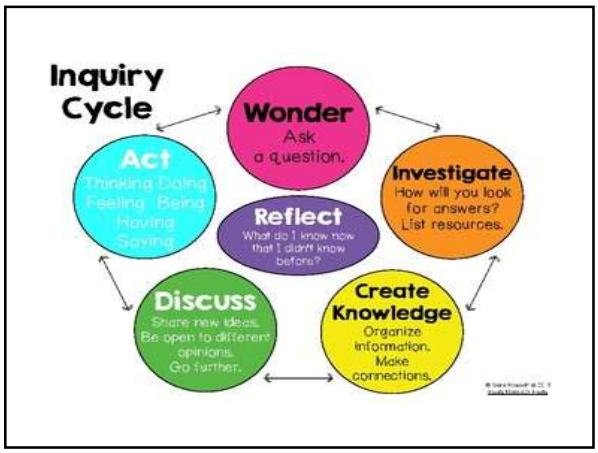
Inquiry Cycle
Wonder
Ask a question.
Investigate
How will you look for answers? List resources.
Reflect
What do I know now that I didn't know before?
Act
Thinking Doing Feeling Being Having Saying
Discuss
Share new ideas. Be open to different opinions. Go further.
Create Knowledge
Organize information. Make connections.

31

THANKS

32

TRAINING MODULE: 7

ASSESSMENT FOR LEARNING (AFL)

TARGET GROUP: TGT SCIENCE _KVS

NUMBER OF SESSIONS: ONE

DURATION: 60 MINUTES

TOPIC: ASSESSMENT FOR LEARNING (AFL)

LEARNING OBJECTIVES / OUTCOMES:

At the end of this session, the participants will be able to

i) evaluate the role of assessment as a tool for learning.

ii) differentiate various assessment strategies

T**RAINING MATERIALS / METHODOLOGY:**

- Computer and LCD Projector
- White board, marker and duster
- Power point Presentation

TRAINING STRATEGY:

- Open Session with discussion on the concept of Assessment as a tool for learning. (20 minutes)
- Various assessment strategies and techniques (30 minutes)
- Open forum to answer any question that may be asked by the trainee. (10 Minutes)

TRAINING SETTING AND SEQUENCE:

- Classroom with the required training materials as listed above.

EVALUATION:

1) How can we differentiate between Assessment of Learning, Assessment for Learning and Assessment as Learning?

REFERENCE:

1) https://bangkok.unesco.org/content/pisa-2015-contextual-data-and-case-digital-divide

2) https://bangkok.unesco.org/content/assessment-learning-bringing-attention-back-learning

3) https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

*****

PROGRAMME FOR INTERNATIONAL SCHOOL ASSESSMENT

PISA

ASSESSMENT FOR LEARNING

1

ASSESSMENT

The action of assessing someone or something.
"the assessment of educational needs"
Synonyms:

Evaluation · judgement · gauging · rating · estimation · appraisal · opinion · analysis · valuation · calculation · computation ·

2

2

Assessment is the only way to know whether what has been taught ,has been learned

Assessment is the bridge between learning and teaching

Assessment is done for selection

3

3

The term assessment refers to the wide variety of methods or tools that educators use to
***Evaluate,**
***Measure,**
***Document the academic readiness, learning progress, skill acquisition, or educational needs of students**

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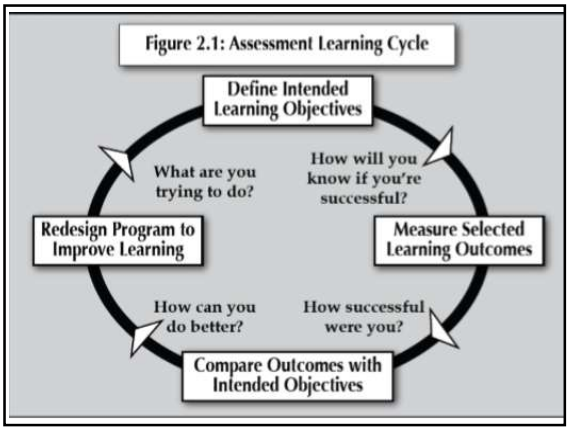

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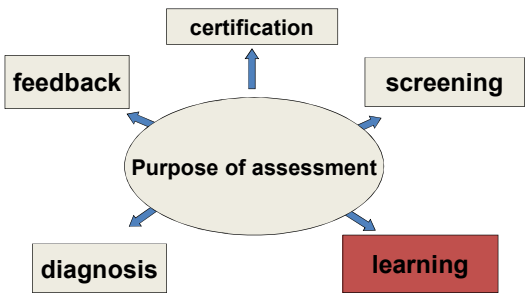
ASSESSMENT IS THE PROCESS OF GATHERING INFORMATION ABOUT CHILDREN'S LEARNING



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According to 'Source Book on Assessment' by NCERT, in science subject, assessment should focus on whether the child has learnt the following:

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7

- Observation: Has the child observed a phenomenon accurately or superficially?
- Experimentation: Has the learner skillfully planned and performed an experiment or activity? Was the learner able to handle the material and equipment properly?
- Measurement: Was the learner able to take and tabulate the readings accurately?
- Analysis and Interpretation: Did the learner use reason for analysing the results of the experiment and interpret them correctly?
- Communication: Did the learner express the outcome in an organised way?

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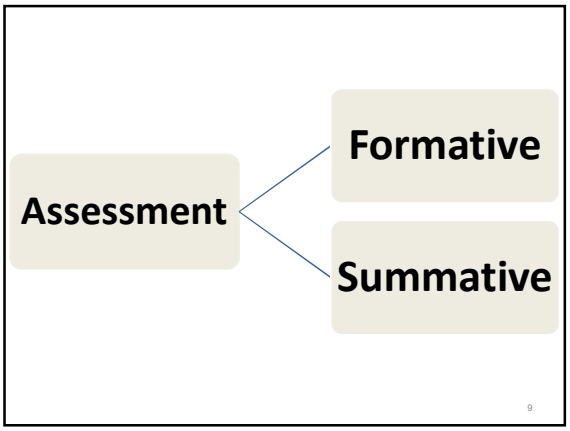

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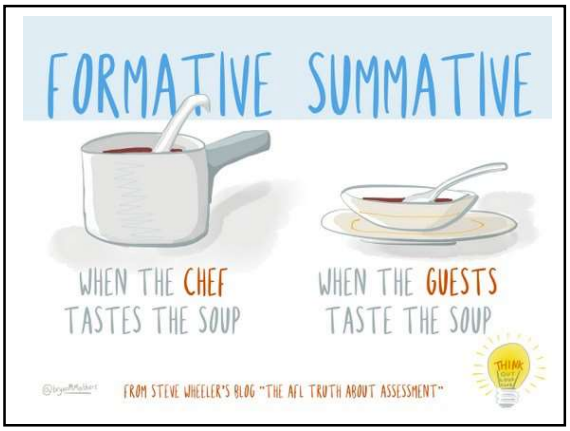

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LET US COMPARE

	Summative (AoL)	Formative (AfL)
Purpose	To find out what students know, understand and can do. To measure the progress they have made	To help students learn (assessment that enhances the learning process)
Timing	Terminal (after the learning)	During the early stages of learning
Examples	Tests and exams	Questioning Feedback (marking & oral) Peer & self assessment
Control	Teacher and external	Teacher and student

11

TWO RECOGNISED 'WAYS' TO ASSESS

- **'Both…and' not 'either…or'**
- **Assessment practice often engages both at the same time**
- **When is one emphasis more appropriate than the other?**

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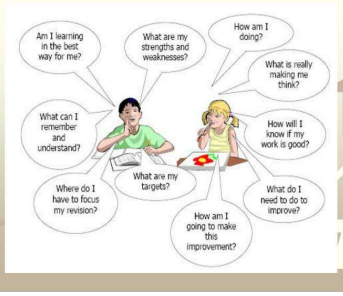
Assessment for Learning



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ASSESSMENT FOR LEARNING (FORMATIVE ASSESSMENT)

Assessment for learning is ongoing assessment that allows teachers to monitor students on a day-to-day basis and modify their teaching based on what the students need to be successful.

This assessment provides students with the timely, specific feedback that they need to make adjustments to their learning.

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AFL – PRINCIPLES AND PLANNING

- **Main Principles of AFL**
- **Rationale**
- **Planning Strategies**

15

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AFL as summarized by Ramaprasad

FORMATIVE ASSESSMENT

- **Where are we going?**
- **Where are we now?**
- **How will we get there?**

16

Where are we going?

This step involves the teacher setting and clarifying learning goals and the information that will be considered as evidence of achieving those learning goals

17

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Where are we now?

This step refers to the specific practices in which teachers seek to understand students' current and prior knowledge, as well as their conceptual framework as they relate to the learning goals

18

18

How will we get there?

This step includes teacher design or modification of instruction to meet students' needs.

19

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Assessment for Learning

	Where the learner is going	Where the learner is	How to get there
Teacher	Clarify success criteria	Check understanding	Teacher Feedback on how to improve
Peer	Share success criteria	Peer Evaluation of criteria	Peer Feedback on how to improve
Learner	Understand success criteria	Self Evaluation of criteria	Pupil Feedback on how to improve

20

AFL in the classroom is characterised by five principles:

- **Sharing the Learning Intention**
- **Sharing the Criteria for Success**
- **Quality Questioning based on Criteria for Success**
- **Providing Feedback based on Criteria for Success**
- **Peer & Self Assessment**

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SHARING THE LEARNING INTENTION

- Students should have clear notion of learning intention of each lesson (put on board at start of class)
- The learning intention is what you hope students will know, understand or be able to do by the end of lesson

Examples:

- By the end of this lesson you should be able to separate sand, salt and water.
- By the end of this lesson you should be able to understand the character of ….
- By the end of this lesson you should be able to draw a diagram of …

22

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SHARING CRITERIA FOR SUCCESS

- Give students clear and easy-to-understand criteria that relate to the learning intention

  Example:

  - you should know how to separate sand, salt and water using certain procedures and you should know the reasons why they are separated
- Help students to know and recognise the standards they are aiming for - show them other students' work which has met with the criteria and explain reasons why.

23

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QUALITY QUESTIONING

Create a classroom environment where <u>all</u> students feel safe to take risks and make mistakes

How would you define a good question?

(Why ask questions in class?)

– One which causes students to think

– One which promotes discussion

– One to which every child has an answer

– One which has a purpose…

Some students for various reasons do not answer in class. How do you encourage these students to answer in class?

24

24

QUESTIONING

When looking at questioning in the classroom we should consider:

- Wait time
- Variety of questioning
- Developing key questions (for key stages of the lesson)
- Quality of questions (Why does..? Could you explain..?)
- Well thought out questions
- Involving more than one student in the answer

25

25

Feedback

Ramaprasad said

"Feedback is information about the gap between the actual level and the reference level of a system parameter which is used to alter the gap in some way."

26

26

FEEDBACK THROUGH COMMENT

How clear is the feedback we give the students?

*Develop these ideas further

*Incorporate example/graph/data to improve your work

*Good answer, could be supplemented with a diagram

*More details needed here

27

27

FEEDBACK THROUGH COMMENT

How does the student interpret the feedback?

*a tick means he probably likes it

*there is a lot of writing at the end—this means it is bad

*this is one of my best because my hand-writing is neat, I checked my spellings and I put in the date'

28

28

FEEDBACK THROUGH COMMENT

Comment only marking vs giving marks

- Students respond to constructive comments more than just grades
- Marks emphasise competition not personal improvement, discourage collaborative learning
- Marks de-motivate low achievers
- Marks don't give learners advice on how their work can be improved

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EFFECTIVE FEEDBACK

Feedback is most effective when it confirms for the students:

their Strengths

their Weaknesses

where to go Next (and how)

(S.W.N.)

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PEER AND SELF ASSESSMENT

Self Assessment

– Students are involved in and responsible for assessing their own piece of work (students know criteria for success)

Peer Assessment

– Students are involved in assessment of the work of other students (students have to have a clear understanding of what to look for in their peers' work)

Peer and self assessment are often considered together. Peer assessment can help self assessment. By judging the work of others, students gain insight into their own performance.

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PEER AND SELF ASSESSMENT

According to the literature, peer and self assessment have several advantages over teacher assessed work. They:

– Require students to take responsibility for their own work (take the initiative)

– Encourage learning through discussion (students required to justify ideas)

– Increase motivation and interest

– Make students think

– Develop collaboration skills

32

32

STRATEGIES FOR SELF ASSESSMENT

- Traffic lighting
  Students are asked to use a colour code to indicate current understanding of learning outcomes
- Samples of work
  Students are given samples of work. They are asked to identify best piece of work, common mistakes and reasons why
- Marking schemes
  Students are given marking scheme and asked to use it to correct their own answers

33

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STRATEGIES FOR PEER ASSESSMENT

- Start in a small way and gradually move forward e.g. get 1st years to swap copies, check that diagrams are labelled, keywords for topics are present
- Give out answers to a test and ask them to correct each other's tests (short test)

34

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AFL TEACHING METHODOLOGIES

- **Comment only marking**
- **Student input into decisions about homework**
- **Students writing questions for tests**
- **Students asking questions**
- **Teacher questioning (no hands!)**
- **Wait time**
- **Group work (on classroom assignments)**
- **Student self-assessment (traffic lights)**
- **Student peer-assessment**
- **Other…**

35

35

WHY ASSESSMENT FOR LEARNING - RESEARCH

- AFL encourages students to become more active and responsible participants in their own learning
- Achievement gains associated with formative assessment have been described as among the largest ever reported for educational interventions (OECD, 2005)
- Formative assessment brings about an improvement in student learning and the improvement is greatest for the weaker student

36

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WHY ASSESSMENT FOR LEARNING – SCHOOL PLANNING & IMPROVEMENT

- Encourages teachers to reflect on their classroom practice
- Embeds culture of innovative practice
- Encourages a collaborative culture among teachers within and across subject areas
- Places teaching and learning on school development agenda
- AFL should be practised more frequently in conjunction with other forms of assessment

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PLANNING CONSIDERATIONS

- Preplanning
- Time etc.
- Roles & Responsibilities
- Once off events – supporting existing procedures / policies
- Criteria re success from students
- Materials
- Info to parents
- Project Implementation
- Evaluation

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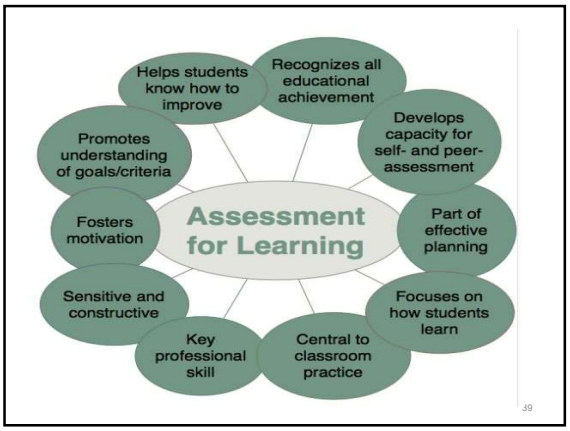

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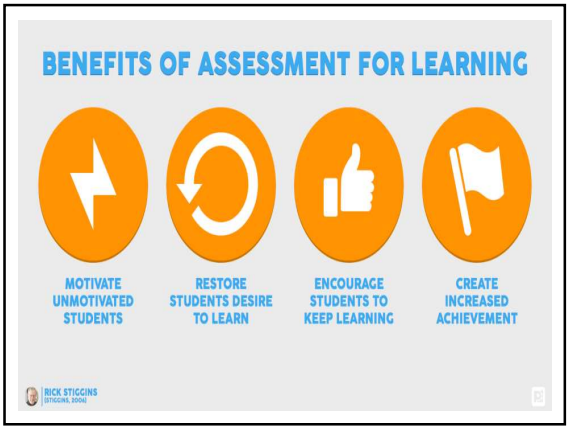

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THANK YOU!

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TRAINING MODULE NO. 8

TARGET GROUP: KVS TGT SCIENCE TEACHERS

TOPIC: CREATING ASSESSMENT FOR LEARNING CLASSROOM

DURATION: 60 Minutes

LEARNING OBJECTIVES/ OUT COMES:

At the end of the session the participants will be able:

- to create classroom for optimum learning and assessment during learning
- to teach concepts of science by inquiry-based method, so as to provide an opportunity to assess students
- to develop scientific thinking and attitude towards the discipline of science

TRAINING MATERIAL/METHODOLOGY:

- ✓ Computer with Internet
- ✓ LCD projector
- ✓ White board and marker
- ✓ Power point presentation

TRAINING STRATEGY:

- ✓ Motivation on the topic/concept –5 minutes
- ✓ Discussion of the topic or concept through enquiry cum discussion method – 20 minutes
- ✓ Collaborative approach (Dividing participants into groups and assigned activity on concept to plan and demonstrate) – 25 minutes
- ✓ open discussion & Evaluation – 10 minutes

TRAINING SETTINGS AND SEQUENCE:

- Training room with the training materials as listed above

EVALUATION: Oral questions /quiz _ group wise

PROGRAMME FOR INTERNATIONAL STUDENT ASSESSMENT

PISA

SESSION: 8

CREATING ASSESSMENT FOR LEARNING CLASS ROOM

1

2

Assessment for learning

- In classrooms where **assessment for learning** is practised, students are encouraged to be more active in their learning and associated assessment.
- The ultimate purpose of assessment for learning is to create self-regulated learners who can leave school able and confident to continue learning throughout their lives.
- Teachers need to know at the outset of a unit of study where their students are in terms of their learning and then continually check on how they are progressing through strengthening the feedback they get from their learners.

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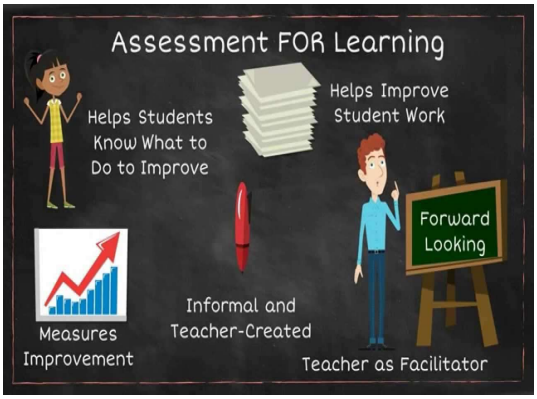

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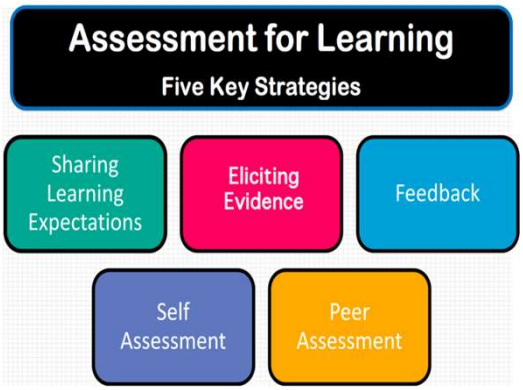

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Educational Assessment Occurs in two major contexts:

1.The classroom assessment is used by teachers and students to assist learning

6

2. Large scale Assessment used by policy makers and Educational leaders to evaluate programmes

7

Three elements for Formative Assessment to promote learning

8

1. A clear view of learning goals

2.Information about the present state of the Learner

3.Action to close the gap

9

These three elements directly related to Assessment:
1.Curriculum and Instructions

2.The present state of learner is derived from Assessment

3.Learning goals can be appraised. Action is taken through instructions to close the gap

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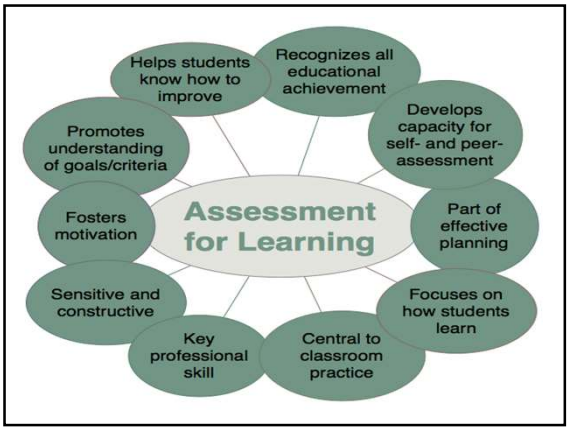

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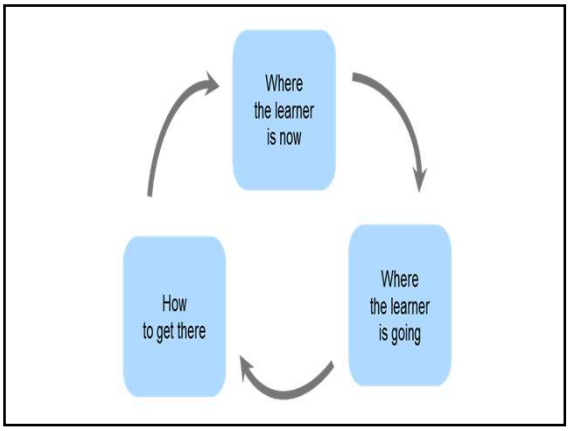

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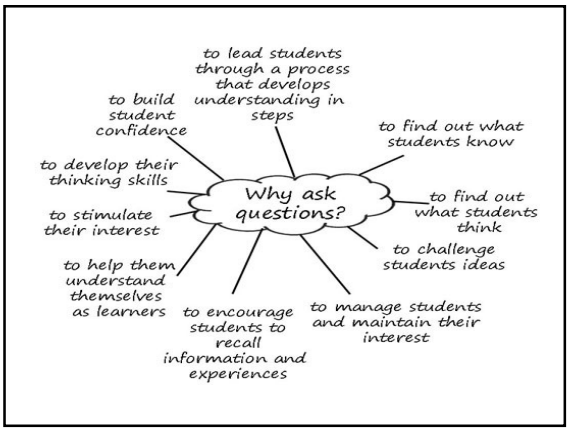

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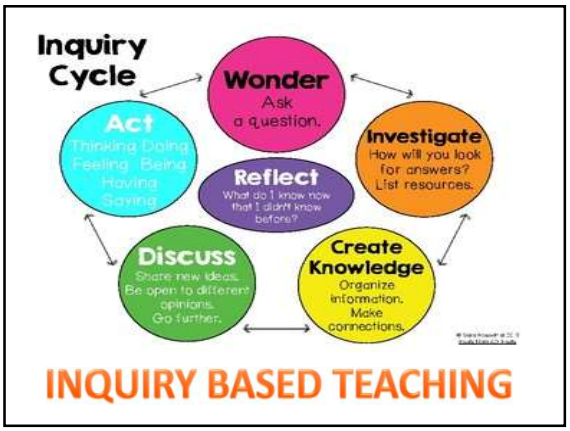

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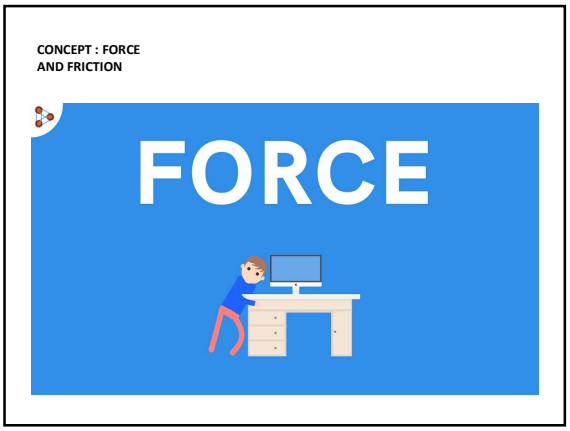

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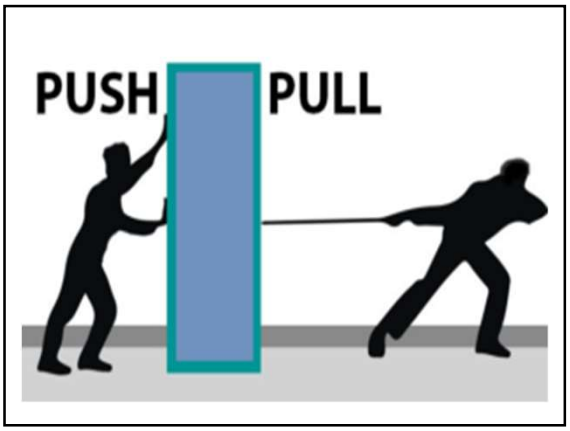

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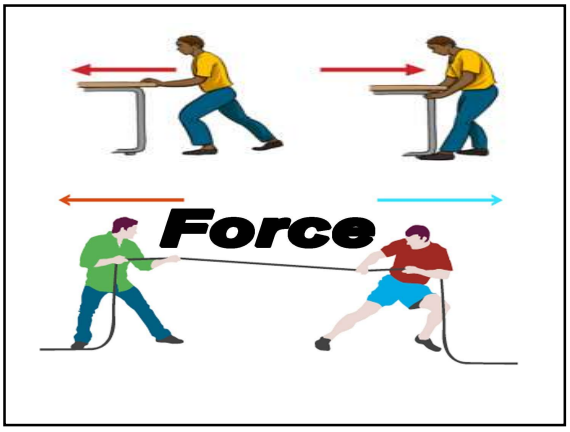

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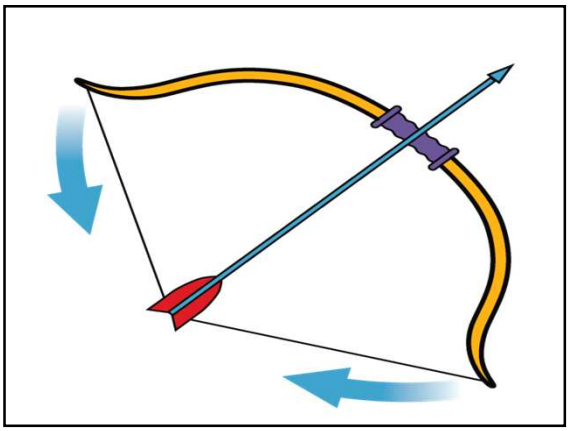

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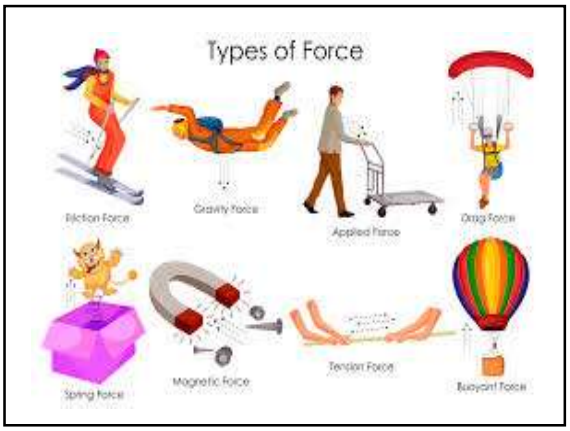

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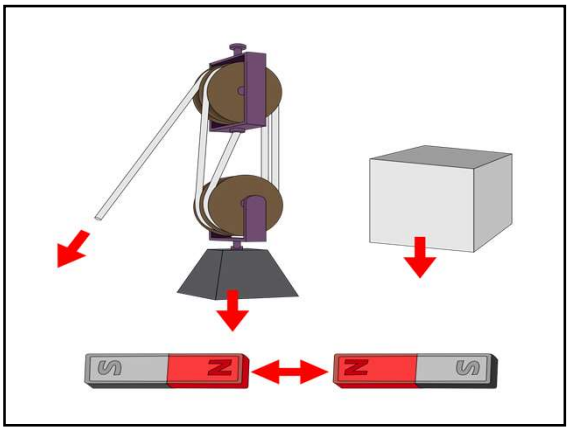

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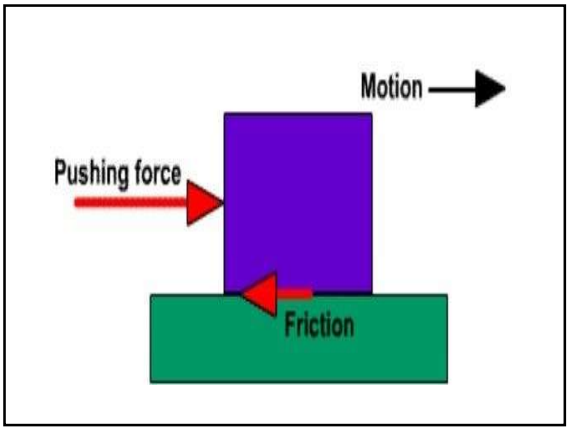

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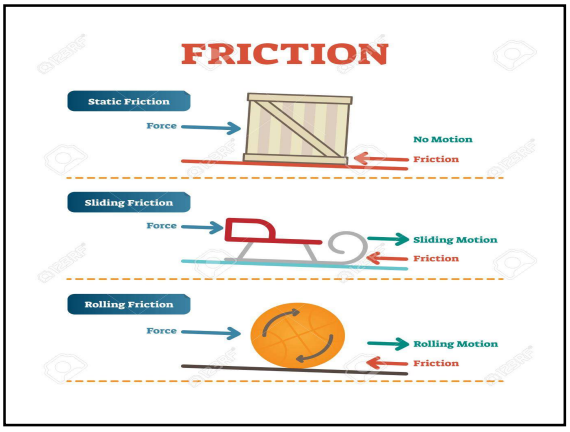

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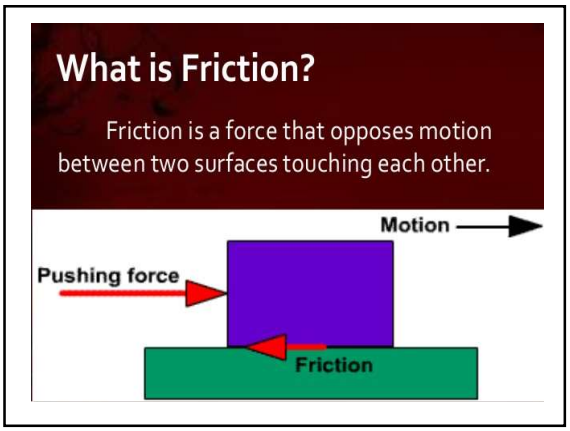
What is Friction?
Friction is a force that opposes motion between two surfaces touching each other.
Motion
Pushing force
Friction

25


Friction
is the
difference
between
the way
things are
and the
way they
should be.

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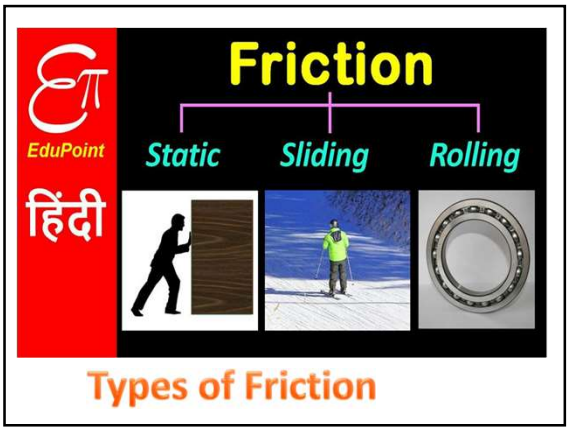
EduPoint
हिंदी
Friction
Static
Sliding
Rolling
Types of Friction

27


THANKS

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TRAINING MODULES: 9 & 10

DEVELOPING QUESTIONS - GUIDED WORK

TARGET GROUP: TGT SCIENCE _KVS

NUMBER OF SESSIONS: TWO

DURATION: 60 MINUTES AND 30 MINUTES EACH

SESSION: One & Two

TOPIC: DEVELOPING QUESTIONS - GUIDED WORK

LEARNING OBJECTIVES/OUTCOME

After attending this session-

- Knowledge of different competencies related to PISA type questions
- Knowledge of PISA Science question paper
- Solving sample questions of PISA
- Will be able to develop PISA type sample science questions with possible answers
- Will be able to do analysis of questions as per PISA competencies and criteria

TRAINING MATERIALS/METHODOLOGY

- Computer with internet connection
- LCD Projector
- White Board & Marker
- Power point presentation

TRAINING STRATEGY

- Exposure to solving sample questions of PISA through power point presentation. (Slides 1- 31 are to be scrolled quickly as these are just for recapitulation) 20 minutes
- Discussion on how to analyze these questions. 05 minutes
- Setting of sample questions and possible answers by already existing group/pair equipped with identified topics. 65 minutes
- Vetting of the same by the team members. 05 minutes
- Each group shall present 1-2 question framed by them with possible answers. 20 minutes
- Open session on the doubts raised by the participants 05 minutes

TRAINING SETTING AND SEQUENCE

Classroom & Computer lab with the required training material as listed above.

TRAINING EVALUATION: Critical review of questions framed by the participants

REFERENCE: NCERT Science Textbook for Classes VI to X

www.oecd.org/pisa/pisaproducts/Take%20the%20test%20e%20book.pdf

TRAINING MODULE: 10 Contd.

SEVEN LEVELS OF PROFICIENCY IN SCIENCE LITERACY

Essential to understand as well as follow while developing PISA type Questions

TARGET GROUP: TGT SCIENCE _KVS

NUMBER OF SESSIONS: ONE

DURATION: 30 MINUTES

SESSION: ONE

TOPIC: SEVEN LEVELS OF PROFICIENCY IN SCIENCE LITERACY

LEARNING OBJECTIVES/OUTCOME

By the end of the session the CPs will be able to:

- Identify the 7 proficiency levels of each test response
- Understand the three broad aspects for reporting on Scientific literacy:
  • access and retrieve • integrate and interpret • reflect and evaluate.

TRAINING MATERIALS REQUIRED:

Soft copy of Power Point Presentation on Seven levels of Proficiency in Print Scientific (17 Slides),
Handout on 7 levels of Proficiency

TRAINING STRATEGY:

Scientific literacy was the major domain assessed in 2000, for the first PISA cycle and in 2009, for the fourth PISA cycle. For the sixth PISA cycle (PISA 2015), Scientific was a minor domain and its framework has not changed from the PISA 2009 cycle (OECD, 2010). There were two major modifications to the PISA 2009 version of the Scientific framework: the incorporation of an assessment of digital Scientific and the elaboration of the constructs of Scientific engagement and metacognition.

The PISA framework for assessing the Scientific literacy of students towards the end of compulsory education, therefore, must focus on skills that include finding, selecting, interpreting and evaluating information from a full range of texts, including those encountered both inside and outside the classroom.

INSTRUCTIONS FOR MTS:

- ✓ Involve the CPs in active discussion
- ✓ Highlight the objectives of the session before the discussion ensues
- ✓ Focus of discussion should be on the levels of proficiency
- ✓ Take the CPs through the power point presentation

PROGRESSION- PRESENTATION ON LEVELS OF PROFICIENCY

Show the title slide to the CPs

- How is proficiency in Science reported in PISA?
- What do the levels of proficiency project about students?
- The seven levels of proficiency in print Science Literacy
- Level 6 is the highest described level of proficiency.
- Level 5 was the highest level before PISA 2009.
- Level 1(b) is the lowest level of proficiency.
- The kind of tasks assigned at level 1(b) and level 1 (a)
- The bottom level of measured proficiency is Level 1b for the PISA 2009 and all subsequent PISA Scientific assessments.
- Level 1 was re-labelled as Level 1a and a new level was added, Level 1b, which describes students who would previously have been rated as "*below Level 1*".
- Detailed discussion of the kind of tasks which are assigned at levels 2, 3, 4, 5 and 6
- Answering the questions that correspond to certain difficulty levels of a score point on the PISA Scientific scale

(*Master trainers can discuss that just as students can be ordered from the least proficient to the highly skilled on a single scale, Scientific literacy tasks are arranged along a scale that indicates progressively the level of difficulty for students and the level of skill required to answer each item correctly. By comparing the position of students and items on these scales, the proficiency of a person can be summarized in terms of his or her ability and the complexity of an item in terms of its difficulty***.)**

Score limits in proficiency levels

(The percentage of students able to perform tasks at each level or above the OECD average to be discussed)

Note: The handout on summary description for the seven levels of proficiency in print Scientific literacy is in the folder along with the Presentation. It should be given to the CPs at the end of the Session.

Annexure-1

SUGGESTIVE TOPICS

*Boiling of water and factors that influence the same i.e. useful during cooking

*Cleanliness and hygiene in preventing ailments

*Earthing and function of Fuse/MCPs as circuit breakers: what to do in such cases? How to fix the same.

*Estimation, approximations and calculations: white washing of buildings, stitching of clothes, cooking etc.

*Pollution, types, harmful effects, Smog formation depletion of water table with human activities, etc. And precautions

*Air, volume, pressure and their relations in football, cycle tyres etc.

*Climate, water cycle, Biogeochemical cycles and their role in sustaining life on earth.

*Structure of flame

*Balanced diet

*Explain processes and phenomenon, e.g., reproduction in human and animals *Production and propagation of sound

*Chemical effects of electric current

*Formation of multiple images

*Conditions required for combustion.

*Do liquids exert equal pressure at the same depth?

*Protecting Biodiversity for ecological balance.

*Purifying water

*Segregating biodegradable and non-biodegradable wastes

*Increasing crop production

*Challenging myths and taboos regarding adolescence

PROGRAMME FOR INTERNATIONAL SCHOOL ASSESSMENT (PISA)

Developing Questions

Day :2

Session: 4 & 5

1

Programme for International Student Assessment

Developing Questions For PISA -2021

2

Scientific Literacy—The structure of the assessment

Item response formats

• Students are presented with units that require them to construct a response to a stimulus and a series of questions (or "items")

• Context is represented in each unit by the stimulus material, which is typically a brief written passage or text accompanying a table, chart , graph, photograph or diagram.

Each unit contains several questions or items

3

Scientific Literacy—The structure of the assessment

Item response formats

• While students need to possess a certain level of reading competency in order to understand and answer the science items, the stimulus material uses language that is as clear, simple and brief as possible while still conveying the appropriate meaning

4

Scientific Literacy—The structure of the assessment

Item response formats

• More importantly, the items require students to use one or more of the scientific competencies as well as knowledge of science and/or knowledge about science

5

Distribution of items

Three types of items are used to assess the competencies and scientific knowledge identified in the framework:

*** Simple multiple-choice items**

– items calling for selection of a single response from four options

– selection of a "hot spot", an answer that is a selectable element within a graphic or text

6

Distribution of items

Three types of items are used to assess the competencies and scientific knowledge identified in the framework:

***complex multiple-choice items**

– items calling for responses to a series of related "Yes/No" questions that are treated for scoring as a single item

– selection of more than one response from a list

7

Distribution of items

***Constructed-response items- (Open and Closed)**

items calling for written or drawn responses

Constructed- response items in scientific literacy typically call for a written response ranging from a phrase to a short paragraph

(e.g. two to four sentences of explanation).

A small number of constructed-response items call for drawing (e.g. a graph or diagram).

Besides binary choice questions are also asked.

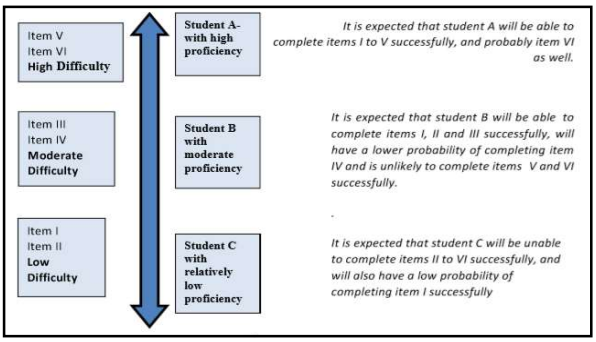
8

Scaling the Scientific Literacy tasks

&

Scientific Literacy Scale

9



10

Let us look at all the reasons why PISA assessments turn out to be difficult for most Indian students.

11

The mentality that questions can only be from the textbook or minor variants of textbook questions

12

READING, READING, READING!

Our average student has very poor reading abilities and usually prefers to guess what the question must be, by glancing through it.

13

Process of answering questions – pattern matching versus problem solving

The strategy that students use to solve questions in typical Indian exams is very different from what is needed for tests like PISA

14

Being put off by the unfamiliar and not proceeding further

Many students freeze at the first sign of the unfamiliar and decide that they have not 'learnt this question type' and cannot solve it.

15

Genuinely low understanding of processes or concepts and even comprehension skills

Actual learning levels and understanding of concepts is low

16

Anatomy of PISA Style Science Questions

17

SCIENCE PASSAGE 1: BUSES

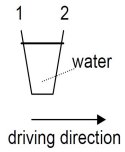
A bus is driving along a straight stretch of road. The bus driver, named Ray, has a cup of water resting on the dashboard:

Suddenly Ray has to slam on the brakes.

Question -1

What is most likely to happen to the water in the cup?

A :The water will stay horizontal.
B :The water will spill over side 1.
C :The water will spill over side 2.
D :The water will spill but you cannot tell if it will spill at side 1 or side 2.



18

BUSES SCORING 1
QUESTION INTENT:
Context: Science & technology
Situation: Personal
Process: Demonstrating knowledge and understanding
Theme: Forces and movement
Level: Medium
Question Format : MCQ type

Full credit C. The water will spill over side 2.
No credit Other responses & Missing.

19

Question 2: BUSES

Ray's bus is, like most buses, powered by a petrol engine. These buses contribute to environmental pollution.

Some cities have trolley buses: they are powered by an electric engine.

The voltage needed for such an electric engine is provided by overhead lines (like electric trains).

The electricity is supplied by a power station using fossil fuels.

Supporters for the use of trolley buses in a city say that these buses don't contribute to environmental pollution.

Are these supporters right? Explain your answer.

.....

20

The process being assessed is demonstrating knowledge and understanding.
Full credit: Gives an answer in which it is stated that the power station also contributes to environmental pollution, such as:
*No, because the power station causes environmental pollution as well.
* Yes, but this is only true for the city itself; the power station however causes environmental pollution.
No credit: No or yes without a correct explanation and missing.

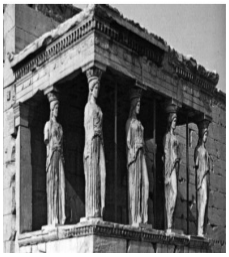
21

QUESTION INTENT:
Context: Science & technology
Situation: Personal
Process: Demonstrating knowledge and understanding
Theme: Forces and movement
Level: Medium
Question format: Open constructed response

22

SCIENCE PASSAGE 2: ACID RAIN

This is a photo of statues called Caryatids that were built on the Acropolis in Athens more than 2500 years ago. The statues are made up of a type of rock called marble. Marble is composed of calcium carbonate.In 1980, the original statues were transferred inside the museum of the Acropolis and were replaced by replicas. The original statues were being eaten away by acid rain.



23

Question 1: Acid Rain

Normal rain is slightly acidic because it has absorbed some carbon dioxide from the air. Acid rain is more acidic than normal rain because it has absorbed gases like sulfur oxides and nitrogen oxides as well. Where do these sulphur oxides and nitrogen oxides in the air come from?

Examples of correct answers (full credit only): Gives any one of car exhausts, factory emissions, burning fossil fuels, or similar, or just refers to pollution.
Examples of incorrect answers: Responses that do not mention 'pollution' and do not give a significant cause of acid rain.

24

Context: Environment
Situation: Global Process: Explaining phenomena scientifically;
Physical systems
Level: High
Question format: Short constructed response

25

Question 2: Acid Rain

The effect of acid rain on marble can be modelled by placing chips of marble in vinegar overnight. Vinegar and acid rain have about the same acidity level. When a marble chip is placed in vinegar, bubbles of gas form. The mass of the dry marble chip can be found before and after the experiment. A marble chip has a mass of 2.0 grams before being immersed in vinegar overnight. The chip is removed and dried the next day. What will the mass of the dried marble chip be?

A Less than 2.0 grams B Exactly 2.0 grams
C Between 2.0 and 2.4 grams D More than 2.4 grams

26

Full credit A. Less than 2.0 grams

No credit Other responses & Missing.

Context: Environment
Situation: Personal Process: Using scientific evidence;Physical systems
Level:Medium
Question format: Multiple choice

27

Question 3: Acid Rain

Students who did this experiment also placed marble chips in pure (distilled) water overnight.
Explain why the students include this step in their experiment.

Examples of correct answers (full credit only): Response explains that the students used water to show that acid (vinegar) is necessary for the reaction.

Examples of incorrect answers: Refers to a comparison with the vinegar and marble test, without clarifying that vinegar is necessary for the reaction; other insufficient, vague, or irrelevant responses.

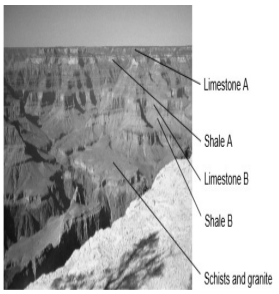
28

Context: Environment
Situation: Personal
Process: Identifying scientific issues; Scientific enquiry
Level: Medium
Question format: Open constructed response

29

SCIENCE PASSAGE 3: The Grand Canyon

The Grand Canyon is located in a desert in the USA. It is a very large and deep canyon containing many layers of rock. Sometime in the past, movements in the Earth's crust lifted these layers up. The Grand Canyon is now 1.6 km deep in parts. The Colorado River runs through the bottom of the canyon. See the picture below of the Grand Canyon taken from its
south rim. Several different layers of rock can be seen in the walls of the canyon.



30

Question 1: **The Grand Canyon**

About five million people visit the Grand Canyon national park every year. There is concern about the damage that is being caused to the park by so many visitors. Can the following questions be answered by scientific investigation? Circle 'Yes' or 'No' for each question.

Can this question be answered by scientific investigation?
Yes/No
How much erosion is caused by use of the walking tracks?
Yes / No
Is the park area as beautiful as it was 100 years ago? Yes / No

31

Full credit Yes Yes No
No credit Other responses & Missing.

Context: Environment
Situation: Social

Process: Identifying scientific issues; Scientific enquiry
Earth and space systems

Level: Medium
Question format: Complex multiple choice

32

Question 2: **The Grand Canyon**

The temperature in the Grand Canyon ranges from below 0 °C to over 40 °C. Although it is a desert area, cracks in the rocks sometimes contain water. How do these temperature changes and the water in rock cracks help to speed up the breakdown of rocks?

A Freezing water dissolves warm rocks.
B Water cements rocks together.
C Ice smoothes the surface of rocks.
D Freezing water expands in the rock cracks.

33

Full credit
D. Freezing water expands in the rock cracks.

No credit Other responses & Missing.

Context: Environment
Situation: Social
Process: Explaining phenomena scientifically;
Earth and space systems
Level : High
Question format: Multiple choice

34

Question 3: **The Grand Canyon**

There are many fossils of marine animals, such as clams, fish and corals, in the Limestone A layer of the Grand Canyon. What happened millions of years ago that explains why such fossils are found there?
A In ancient times, people brought seafood to the area from the ocean.
B Oceans were once much rougher and sea life washed inland on giant waves.
C An ocean covered this area at that time and then receded later.
D Some sea animals once lived on land before migrating to the sea.

35

Full credit
C. An ocean covered this area at that time and then receded later.

No credit Other responses & Missing.

Context; Environment
Situation: Global
Process: Explaining phenomena scientifically;Earth and space systems

Level: High
Question format: Multiple choice

36

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

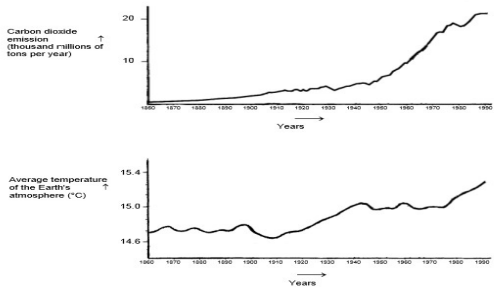
THE GREENHOUSE EFFECT: FACT OR FICTION? Living things need energy to survive. The energy that sustains life on the Earth comes from the Sun, which radiates energy into space because it is so hot. A tiny proportion of this energy reaches the Earth. The Earth's atmosphere acts like a protective blanket over the surface of our planet, preventing the variations in temperature that would exist in an airless world. Most of the radiated energy coming from the Sun passes through the Earth's atmosphere. The Earth absorbs some of this energy, and some is reflected back from the Earth's surface. Part of this reflected energy is absorbed by the atmosphere. As a result of this the average temperature above the Earth's surface is higher than it would be if there was no atmosphere. The Earth's atmosphere has the same effect as a greenhouse, hence the term greenhouse effect. The greenhouse effect is said to have become more pronounced during the twentieth century. It is a fact that the average temperature of the Earth's atmosphere has increased. In newspapers and periodicals the increased carbon dioxide emission is often stated as the main source of the temperature rise in the twentieth century.

37

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

A student named André becomes interested in the possible relationship between the average temperature of the Earth's atmosphere and the carbon dioxide emission on the Earth. In a library he comes across the following two graphs.

38



39

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

André concludes from these two graphs that it is certain that the increase in the average temperature of the Earth's atmosphere is due to the increase in the carbon dioxide emission.

40

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 1: GREENHOUSE
Question intent: Using scientific evidence
What is it about the graphs that supports André's conclusion?

……

41

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 1

Correct Answers that refer to the increase of both (average) temperature and carbon dioxide emission.

Incorrect
Answers that refer to the increase of either the (average) temperature or the carbon dioxide emission.

Answers that refer to temperature and carbon dioxide emission without being clear about the nature of the relationship.

Other responses.

42

Context: Environment
Situation: Global

Process: Using scientific evidence

Level : High
Question format: Open constructed type

43

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2: GREENHOUSE
Question intent: Using scientific evidence
Another student, Jeanne, disagrees with André's conclusion. She compares the two graphs and says that some parts of the graphs do not support his conclusion. Give an example of a part of the graphs that does not support André's conclusion. Explain your answer.

.....

44

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

Fully Correct Answers that refer to one particular part of the graphs in which the curves are not both descending or both climbing and gives the corresponding explanation, such as:

In 1900–1910 (about) CO_2 was increasing, whilst the temperature was going down.

In 1980–1983 carbon dioxide went down and the temperature rose.

45

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

The temperature in the 1800's is much the same but the first graph keeps climbing.

Between 1950 and 1980 the temperature didn't increase but the CO_2 did.

From 1940 until 1975 the temperature stays about the same but the carbon dioxide emission shows a sharp rise.

In 1940 the temperature is a lot higher than in 1920 and they have similar carbon dioxide emissions.

46

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

Partially Correct

Answers that mention a correct period, without any explanation.
Answers that mention only one particular year (not a period of time), with an acceptable explanation.

47

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

Partially Correct
Answers that give an example that doesn't support André's conclusion but makes a mistake in mentioning the period. [Note: There should be evidence of this mistake – e.g. an area clearly illustrating a correct answer is marked on the graph and then a mistake made in transferring this information to the text.]

Answers that refer to differences between the two curves, without mentioning a specific period.

48

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

Partially Correct

Answers that refer to an irregularity in one of the graphs.

Answers that indicate difference in the graphs, but explanation are poor.

49

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 2

Incorrect
Answers that refer to an irregularity in a curve without referring specifically to the two graphs.
Answers that refer to a poorly defined period or year without any explanation.
Other responses.

50

Context: Environment
Situation: Global
Process: Using scientific evidence
Level : High
Question format: Open constructed type

51

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 3:
Question intent: Explaining phenomena scientifically

André persists in his conclusion that the average temperature rise of the Earth's atmosphere is caused by the increase in the carbon dioxide emission. But Jeanne thinks that his conclusion is premature. She says: "Before accepting this conclusion you must be sure that other factors that could influence the greenhouse effect are constant". Name one of the factors that Jeanne means.

.....

52

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 3:
Question intent: Explaining phenomena scientifically

Correct
Answers that give a factor referring to the energy/radiation coming from the Sun.
Answers that give a factor referring to a natural component or a potential pollutant.

53

SCIENCE PASSAGE 4: THE GREENHOUSE EFFECT: FACT OR FICTION?

Question 3:
Question intent: Explaining phenomena scientifically

Incorrect
Answers that refer to a cause that influences the carbon dioxide concentration.

Answers that refer to a non-specific factor.

Other incorrect factors or other responses.

54

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : High
Question format: Open constructed type

55

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Regular but moderate physical exercise is good for our health.

56

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Question 1: PHYSICAL EXERCISE
Question intent: Explaining phenomena scientifically
What are the advantages of regular physical exercise? Circle "Yes" or "No" for each statement.

Is this an advantage of regular physical exercise?	Yes or No?
Physical exercise helps prevent heart and circulation illnesses.	Yes /No
Physical exercise leads to a healthy diet.	Yes/ No
Physical exercise helps to avoid becoming overweight.	Yes/ No

57

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Question 1: PHYSICAL EXERCISE
Question intent: Explaining phenomena scientifically

SCORING:
Correct
All three correct: Yes, No, Yes in that order.

Incorrect
Other responses.

58

Context: Health
Situation: Social/Personal
Process: Explaining phenomena scientifically
Level : Medium
Question format: Complex MCQ

59

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Question 2: PHYSICAL EXERCISE
Question intent: Explaining phenomena scientifically
What happens when muscles are exercised? Circle "Yes" or "No" for each statement.

Does this happen when muscles are exercised?	Yes /No
Muscles get an increased flow of blood.	Yes/ No
Fats are formed in the muscles.	Yes/ No

60

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Question 2: PHYSICAL EXERCISE

SCORING:
Correct Both correct: Yes, No in that order.

Incorrect Other responses.

61

Context: Health
Situation: Social/Personal
Process: Explaining phenomena scientifically
Level : High
Question format: Complex MCQ

62

SCIENCE PASSAGE 5: PHYSICAL EXERCISE

Question 3: PHYSICAL EXERCISE
Question intent: Explaining phenomena scientifically

Why do you have to breathe more heavily when you're doing physical exercise than when your body is resting?
.....

63

Question 3: PHYSICAL EXERCISE

SCORING:
Correct
*To remove increased levels of carbon dioxide and to supply more oxygen to your body. [Do not accept "air" instead of "carbon dioxide" or "oxygen".]
*To remove increased levels of carbon dioxide from your body or to supply more oxygen to your body, but not both. [Do not accept "air" instead of "carbon dioxide" or "oxygen".]

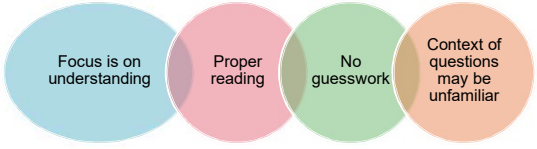
Incorrect Other responses.

64

Context: Health
Situation: Social/Personal
Process: Explaining phenomena scientifically
Level : High
Question format: Closed construct type

65

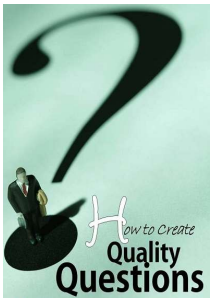
Thus PISA test is different



66

67

Let us see



68

Developing PISA Science Questions

Step -1

Identification of Concept/Topic on which Questions are to be framed

69

Developing PISA Science Questions

Step - 2

List the major and minor concept/ideas connected to the topic

70

Developing PISA Science Questions

Step -3

write related stanza in clear, understandable and unambiguous language

71

Developing PISA Science Questions

Step - 4

Support written brief with relevant pictures, data , graph etc.

72

Developing PISA Science Questions

Step - 5

Shortlist the possible concept /ideas that can be tested in the light of PISA Scientific Literacy Competencies

73

Developing PISA Science Questions

Step - 6

Now frame questions considering PISA Scientific Literacy Competencies

74

Developing PISA Science Questions

Step - 7

Analyse each Question as follows

Context /Area
Situation
Process
Level
Item response format

75

Developing PISA Science Questions

Step - 8

Write probable answer/answers

For MCQ:
One correct option and 3 incorrect options
For Open constructed questions: all possible answers

76

Developing PISA Science Questions

Please avoid using common errors committed / misconceptions prevailing in students

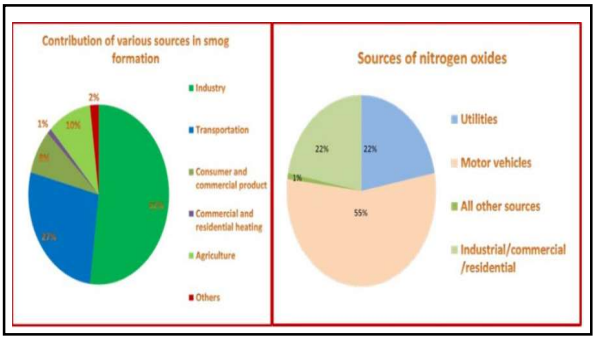
77

Q.1 SMOG:The word smog is derived from smoke and fog. It is an airborne pollution It is caused by small particles of material which become concentrated in the air for a variety of reasons. Commonly, smog is caused by an inversion, in which cool air presses down on a column of warm air, forcing the air to remain stationary.
There are two types of smog:classical and photochemical smog.
Classical smog occurs in cool humid climate. It is a mixture of smoke, fog and sulphur dioxide. It is also called reducing smog.

Photochemical smog occurs in warm and dry sunny climate. It is formed due to chemical reaction between sunlight and pollutants like hydrocarbons and nitrogen dioxide. It has high concentration of oxidizing agents and therefore ,it is also called as oxidizing smog.

Health effects of smog include breathing problems, cough, eye, nose and throat irritation, heart diseases, reduced resistance to colds and pneumonia.
Environmental effects involve damage to plants and trees. Additionally, Smog reduces visibility considerably leads to traffic chaos.

78



79

Q.1.1 SMOG is caused due to:

A.Emissions from vehicles
B.From incinerators
C.Oil paints
D.All of the above

80

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : Medium
Question format: MCQ

81

Scoring

Full credit D. All of the above

No credit Other responses & Missing.

82

Q.1.2 Which of the following is the major photochemical smog?

A.Peroxyl acetyl nitrate
B.Sulphur dioxide
C.Hydrogen peroxide
D.Chlorofluorocarbon

83

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : High
Question format: MCQ

84

Scoring

Full credit D. Chlorofluorocarbon

No credit Other responses & Missing.

85

Q.1.3 Photochemical smog is misnomer as it does not contain any smoke or fog. Why is it so called ?

.....
.....

86

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : Medium
Question format: Close construct type

87

Scoring

Full credit Ans It takes place in presence of sunlight

No credit Other responses & Missing.

88

Q.1.4 Classical smog is also known as London smog and photochemical smog is also known as Los Angeles smog. In this context circle 'Agree' or 'Disagree' for each of the followings facts:

a.Photochemical smog is formed during summer season. Agree/Disagree
b. Classical smog is oxidizing in nature. Agree/Disagree
c. Classical smog is formed due to reaction of sulfur dioxide gas and water. Agree/Disagree

89

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : High
Question format: Complex MCQ

90

Scoring

Full credit Ans a.agree
b.disagree
c.agree

No credit Other responses & Missing.

91

Q.1.5 Give any two methods to control smog formation.

……
……

92

Context: Environment
Situation: Global
Process: Explaining phenomena scientifically
Level : Medium
Question format: Open construct type

93

Scoring

Full credit Ans Any two methods as
Use of renewable energy in place of coal in power plants
Reducing and managing vehicular and industrial emissions
Increasing energy efficiency and conserving energy
Use of environmentally friendly consumer products
Tight emissionsregulations on vehicles and factories are one such step
Use of hybrid or electrical vehicle
Use of bicycle
Car/Bus pooling
Government agencies must monitor air quality through testing, citing companies which violate the law and issuing warnings when smog levels are dangerous. etc

No credit Other responses & Missing.

94

Q.2 Dengue is a mosquito-borne viral infection causing a severe flu-like illness and, sometimes causing a potentially lethal complication called severe dengue. The incidence of dengue has increased 30-fold over the last 50 years.
The full life cycle of dengue fever virus involves the role of mosquito as a transmitter (or vector) and humans as the main victim and source of infection. The female *Aedes aegypti* mosquito is the main vector that transmits the dengue virus (DEN). The viruses are passed on to humans through the bites of an infective female *Aedes* mosquito, which mainly acquires the virus while feeding on the blood of an infected person.
Symptoms of dengue fever closely resembles with chikungunya, and Zika fever.
Symptoms, which usually begin four to six days after infection and last for up to 10 days, may include Sudden high fever,Severe headaches,Severe joint and muscle pain,Skin rashes, bleeding from body opening /orifice etc.

95

Q.2.1 Incubation period is the time elapsed between exposure to a pathogenic organism (a chemical, or radiation) and when symptoms and signs are first apparent. What happens during this period?
……
……

96

Context: Health
Situation: Global
Process: Explaining phenomena scientifically
Level : High
Question format: Closed construct type

97

Scoring

Full credit
In a typical infectious disease, incubation period signifies the period taken by the multiplying organism to reach a threshold, necessary to produce symptoms in the host.
No credit Other responses & Missing.

98

Q.2.2 In the context of dengue fever circle 'Agree' or 'Disagree' for each of the following facts:

Mosquitos are the source of infection for dengue fever	Agree/ disagree
Dengue fever effects blood platelets count of the infected person	**Agree/ disagree**
Sudden high fever, joint pain and skin rashes are not always an indicator of dengue fever.	**Agree/ disagree**

99

Context: Health
Situation: Global
Process: Explaining phenomena scientifically
Level : Medium
Question format: Complex MCQ

100

Full credit Disagree,
agree,
agree in this order

No credit Other responses & Missing.

101

Q.2.3 Dengue fever usually remains associated with Nasal/oral/vaginal bleeding.
Give probable cause of that .

102

Context: Health
Situation: Global
Process: Explaining phenomena scientifically
Level : High
Question format: Closed construct type

103

Full credit : Dengue virus, the main cause of dengue fever induces bone marrow suppression. Since bone marrow is the manufacturing centre of blood cells its suppression causes deficiency of blood cells leading to low platelets count. Low platelets count is responsible for gum bleeding and bleeding from body orifices /openings(internal and external) as Nasal opening /Ear opening/vaginal etc.

No credit: Other responses & Missing.

104

Let us Start

105

TRAINING MODULE:11

SCIENCE AROUND US

TARGET GROUP: TGT SCIENCE _KVS

NUMBER OF SESSIONS: ONE

DURATION: 60 MINUTES

TOPIC: SCIENCE AROUND US

LEARNING OBJECTIVES/OUTCOME

After attending this session-

- Participants will be able to focus on the interlinkages of the concept taught in the class with the world around the class and with other disciplines.
- Will be able to distinguish between an invention and a discovery.
- Will be Able to use everyday ideas/conversations/context to teach science.
- Will be able to demonstrate through daily routine/experiences/available resources.
- Will be able to identify topics which later are to be utilized for framing of PISA questions.

TRAINING MATERIALS/METHODOLOGY

- Computer with internet connection
- LCD Projector
- White Board & Marker
- Power point presentation

TRAINING STRATEGY

Presentation of concept through power point

- Discussions and deliberations on happenings around us and their scientific reasonings. 30 minutes
- Division of participants into pair/group as per total number of participants
  5 minutes
- Pair/Group shall be asked to identify topics of Science around us which will be later utilized for framing PISA questions. 20 minutes
- Open session on the doubts raised by the participants 05 minutes

TRAINING SETTING AND SEQUENCE

Classroom with the required training material as listed above.

TRAINING EVALUATION:

Q.1In your opinion what is the importance of Science in our day to day life?

Q.2 List out any two scientific observations exists in an Indian kitchen.

REFERENCE: NCERT Science Textbook for Classes VI to X

http://vikaspedia.in/education/teachers-corner/bloom-s-taxonomy-of-learning-domains

http://www.gly.uga.edu/railsback/1122science2.html

www.gly.uga.edu/railsback/1122science2.html

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PROGRAMME FOR INTERNATIONAL SCHOOL ASSESSMENT

PISA

Science all Around Us

1

2

Science

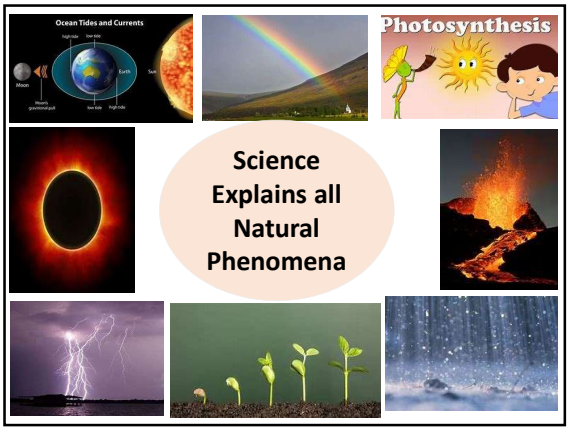
(from the Latin word scientia, meaning "knowledge")

It is the knowledge we get When we ask questions

3

Systematized knowledge derived from
Observation
Study
and Experimentation
Carried on
in order to determine the nature or principles of what is being studied

4



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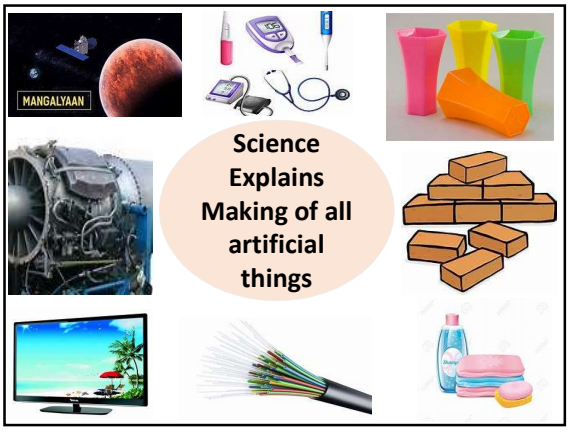

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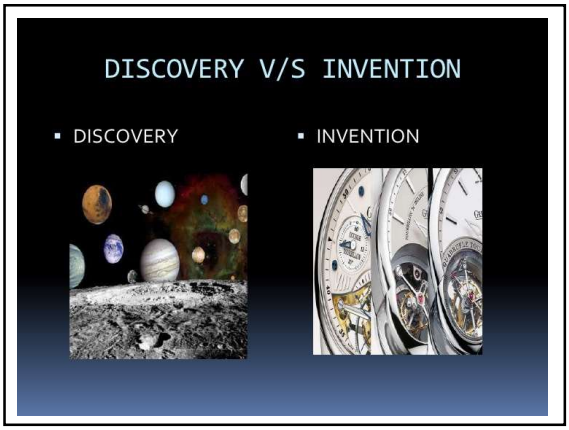

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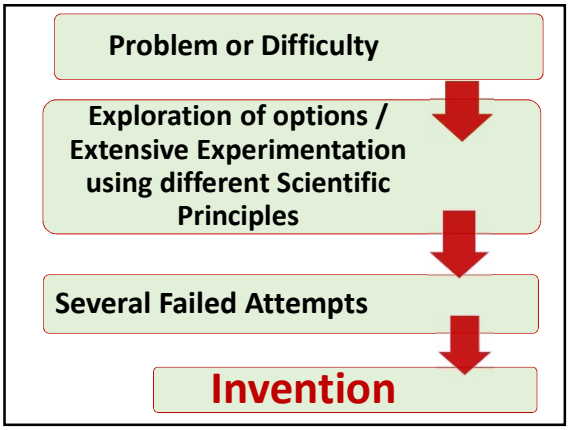

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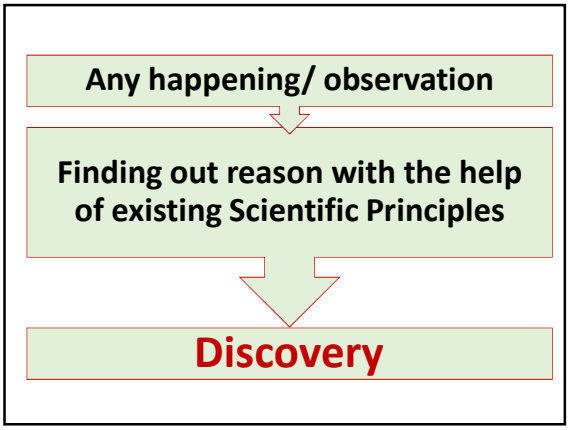

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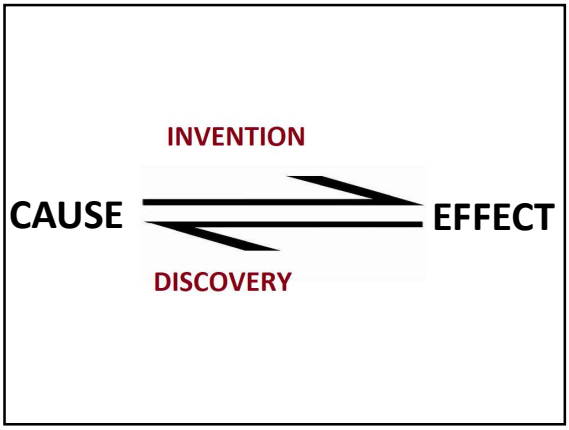


10

Invention	Discovery
An invention is an artificial creation by humans , that did not exist in the past	Discovery is finding out something that already existed but not known
It is a process	It is not a process
Nothing to do with nature	Everything to do with nature
It is scientific	It is natural

11

Invention	Discovery
The telephone by Graham Bell Light-bulb by Thomas Alva Edison. Computer by Charles Babbage Marconi invented Radio	Discovery of America by Columbus. Gravity by Isaac Newton. Plant cell by Robert Hooke. Radioactivity by H.Becquerel

12

Preparation of Lime water

This simple activity: Exclusively Scientific

13

Whatever we throw falls on the ground

Science Explains: This is due to gravitational pull

14

Water from earthen pot is cooler?

Its SCIENCE: Evaporation

15

Significant Invention of SCIENCE

16

Pulley is application of SCIENCE

17

How does Butterfly land on a bush

Can be explained using SCIENCE

18

How do trees heal themselves?
How does a tree choose where to grow a new branch? (Nature)

Can be explained by Science

19

Why do some trees Shed bark?

Science Explains that

20

What causes some trees to stay green and others to lose their leaves?

Science Clarifies

21

What do birds use to make their nests?
How do they seem to defy gravity?

We could understand using SCIENCE

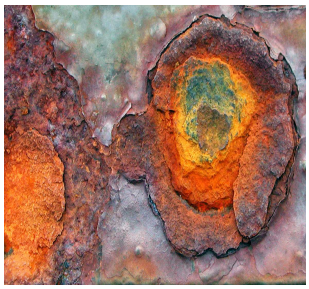
22

Wild Turkeys in your courtyard

Animals, Ecosystem & Migration of Birds : again Science

23

Iron objects got rusted and silver objects undergo tarnishing?



SCIENCE can explain: Redox Reactions

24

What causes the soda to shoot out? Why does it shoot up?

We understand by the study of SCIENCE

25

Enjoying Snowfall

Precipitation & Weather SCIENCE again

26

Playing Football?

In all sports & Games activities: SCIENCE is there

27

Riding the waves at the Beach?

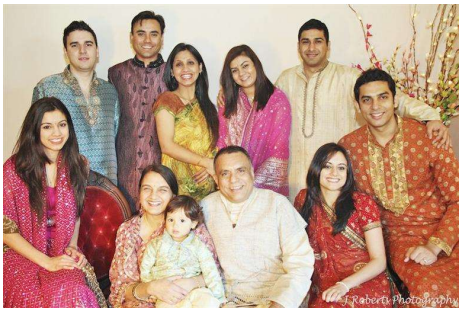
SCIENCE: Forces & Motion

28

Enjoying Parenthood

This is also SCIENCE (Reproduction)

29

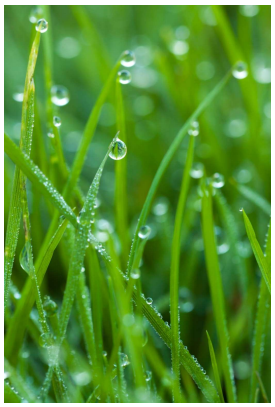


FAMILY

Science is involved here also (Genes and DNA)

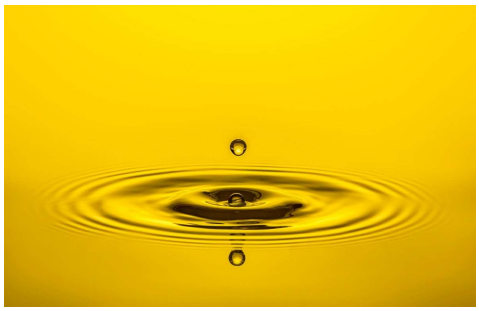
30

What causes dew?



We understand using SCIENCE

31



Shape of the oil drop is Spherical ?

again Science

32

What makes flowers grow?

Can be explained using SCIENCE

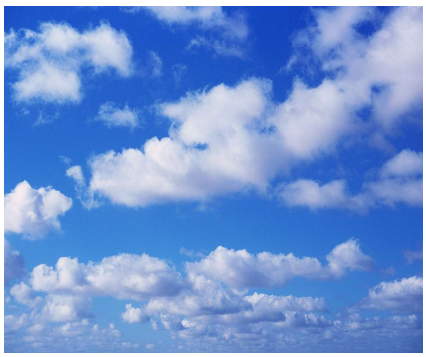
33

How does that fly stay on the window?

SCIENCE Explains

34

Why is the sky blue? Why do some clouds look thin?



We conclude through Science

35

How does the sun make a shadow?

We understand using SCIENCE

36

How are waterfalls formed?

We know by virtue of SCIENCE

37

What causes a concrete pavement to crack?

again our knowledge of SCIENCE

38

Why does snow appear white in colour while water is transparent / colourless?

Yes, we know through SCIENCE

39

How does snow stick to a vehicle?

But snow doesn't get stuck to concrete?

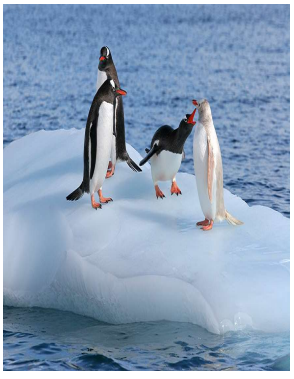
Its SCIENCE again

40

Ice floats on water despite being a solid

It hugely affects marine life

SCIENCE can Explain



41

Why do Onions make us cry?

Science can answer

42

We add salt and sugar in pickles and murabbas?

This is Science in Kitchen

43

Crompton Anti Bacterial bulb

Does it actually eliminate bacteria ?and if so, is it safe for prolonged exposure?

44

Do fairness creams really work?

45

Is It Okay To Use any Detergent in the Dishwasher?

46

47