

Broadening Horizons of Science Learning I

Historical Perspective for teaching Science
Benefits of Reading for Science Learning

Day :1

Session: 5

The need of Historical Perspective for Teaching Science

Why Study History for Science?

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

Efficiency

Perspective

Imagination

Education and public understanding of science

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.

It all starts with the Greeks

The Ancient Greeks are seen, in the west, as our intellectual forefathers. From Greece was born philosophy, drama, western artistic aesthetics, geometry, etc., etc., etc.

Theology was never an important aspect of Greek thought and Orthodoxy was practically disliked.

Ancient Greek society did not have a permanent priestly class that imposed dogma.

Greek Gods & Goddesses were NOT omnipotent nor omniscient.

Aristotle (384-322 BC)

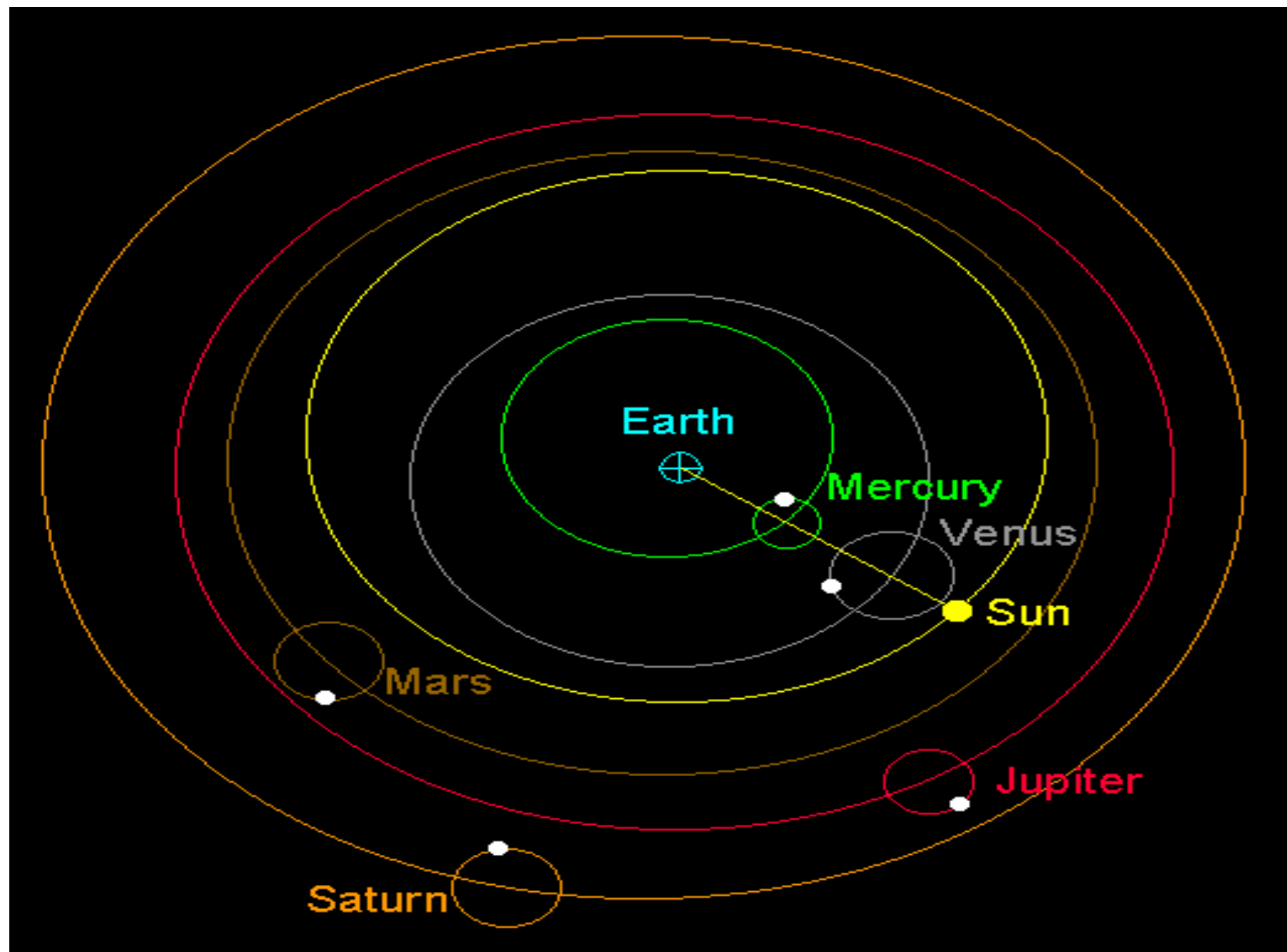
- Tutor to Alexander the Great
- Scala Natura
- His philosophy later adopted by the Christian West
- Considered as the Father of Biology.



- Aristotle created a hierarchy of all living things, from simple to more complex. Although he did not mean to imply evolution, it nevertheless ranked all of creation from great to small.
- This later became the "Great Chain of Being" - a hierarchically ordered system with God & angels at the top, progressing downward from more to lesser developed (moral/perfect) beings.

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!



Greek Civilization

European Medieval thinking

- Fall of the Roman Empire (~478 AD)
- Arab civilization
- Europe

- According to the Church, all that could be known about the world came from the bible.
- Creation had been perfect
- Degeneration:

The Day the Universe Changed

The "New World"

- The "discovery" of the Americas
- There were several troubling aspects to the discovery.

- Bible had absolutely nothing to say about the Americas
- Europeans met people entirely ignorant of God, Christ, etc.
- The plants and animals of the Americas were unknown

- This led to

- 1) recognition that the Bible was not the ultimate authority on nature

- 2) debate over the nature of Indigenous people (were they animals or humans?)

- 3) classification of the animals & plants.

- 4) the fact that no one knew anything about the Americas sparked curiosity - the need to know.

Of course, there were many other ramifications to European domination of the Americas -

- Economic:

- Power:

- Politics:

Our concern here, however, is in science.

- The separation of church and science.
- science would largely reject theology as a way of knowing the natural world.
- This would be a difficult period with many wounded - but the process was almost inevitable.

Creationism

Several compelling Christian dogmas are important to note:

- 1) *Genesis*: GOD created earth in 6 days (don't forget - he took the last day off).

Creation was also centered around Earth & Man (we are in his image).

2) Relative Youth of the Earth

there was a lot of debate about the exact age .
.. but most theologians agreed it wasn't so long ago.

If the earth was indeed less than 6000 years old, then gradual change could not have occurred.

3) The Fixity of Species

Likewise, after God created plants & animals, these retained their true, original form, generation after generation.

- no species had been lost
- no species had changed

Nevertheless, people did understand the process of selective (or artificial) breeding.

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.

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

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.

Artificial Selection

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

BENEFITS OF READING FOR SCIENCE LEARNING :

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

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*.

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.

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?

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?

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

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.

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.

New Knowledge Economy Demands

Skills of a practical and intellectual (cognitive) nature:

- | | |
|---------------------|-----------------------------|
| - Problem solving | Language |
| - Literacy | Interactivity |
| - Numeracy | Cooperation |
| - Creativity | Patience |
| - Critical thinking | Proper values and attitudes |
| - Analyzing | Personal motivation |
| - Estimating | Honesty |
| - Computing | Respect |
| - Evaluating | Ethics |

Science Is A Continuing Success Story

There are limits to science but science works:

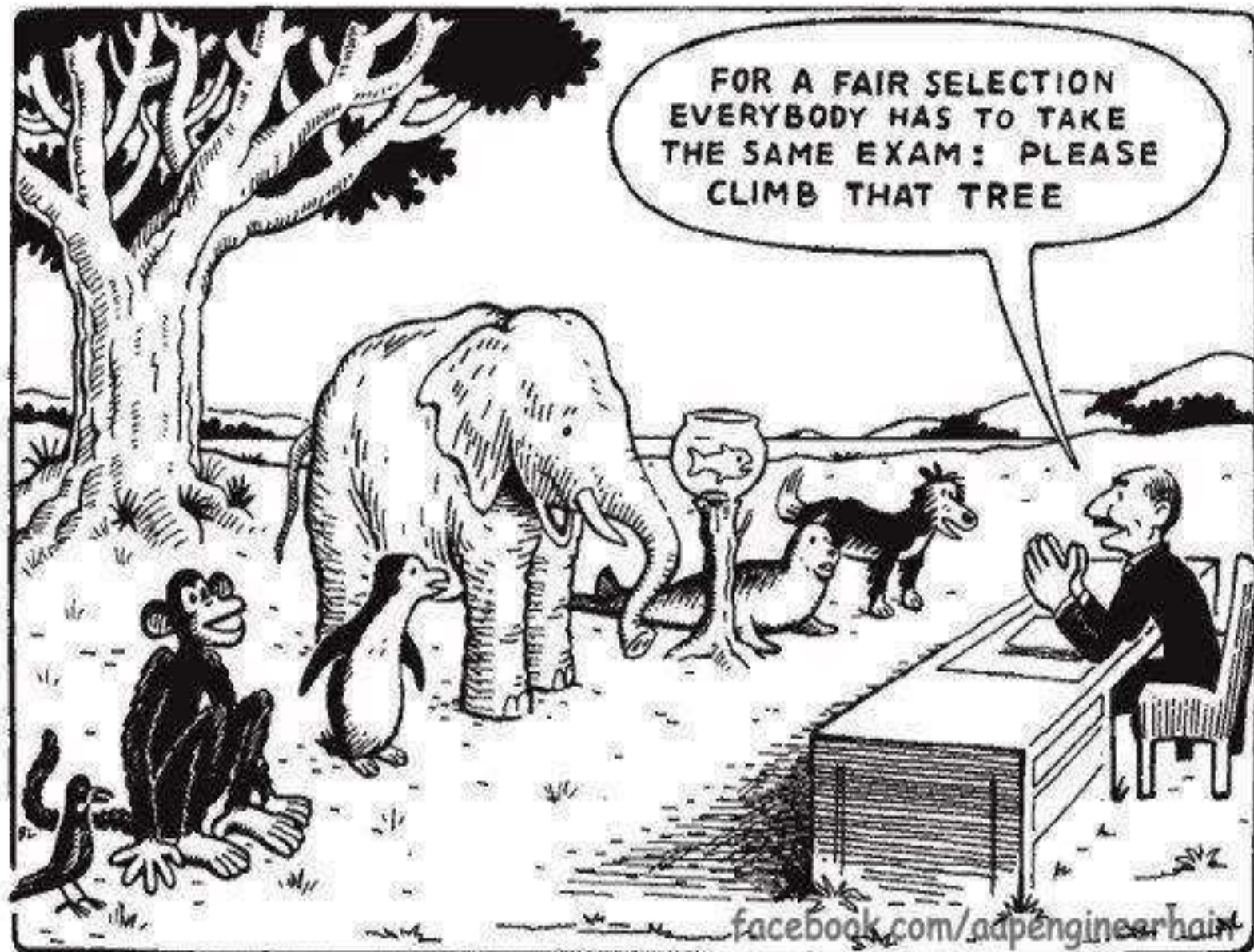
- ▶ helps to judge between expert advice and misinformation.
- ▶ science affect lives - no middle ground.
- ▶ scientific knowledge although universal must have local components and be renewed.
- ▶ Every person and country has responsibility and must be given opportunity
- ▶ Success must be followed and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

Three Metaphors of Learning

- 1) Learning is making sense of experiences
- 2) Learning is an exercise in meaning making
- 3) Learning is Knowledge Construction



Science Behind this event??



THANK YOU!