On teaching “Scientific Thinking” : A collaborative approach to a student-centered active learning and technology-enhanced course design

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Scientific Thinking: Concept and Mission

- University-wide graduation requirement
  - Current format since Fall 2004
- Introduces the “tools” of scientific thinking to a multidisciplinary audience
- Supports *application* of critical analysis

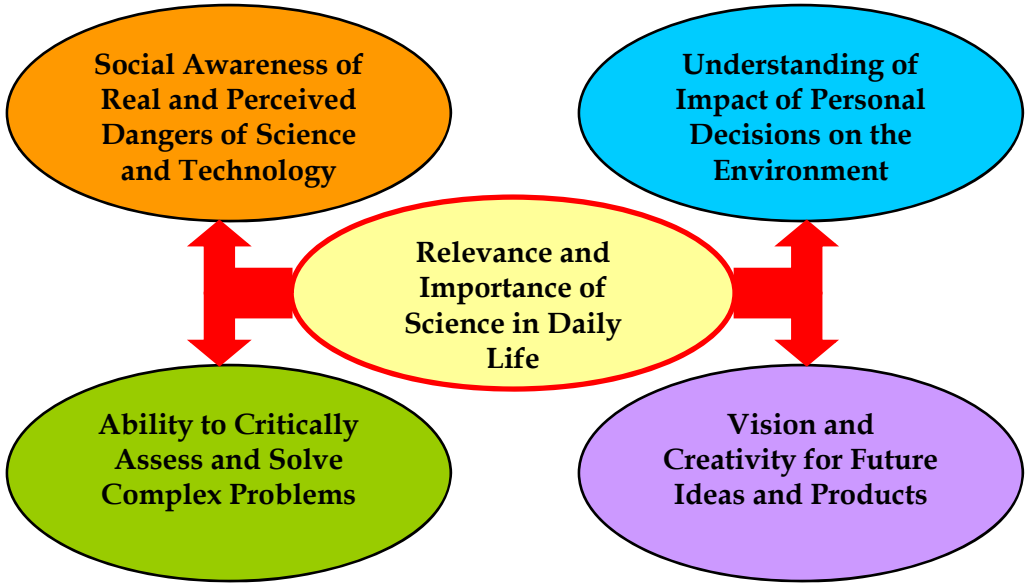


Image adapted from: http://websekolah.bharian.com.my/F1Sci/nov17.html

Scientific Thinking: Paradigm Focus

- Student investment
- Perceived relevance
  - For science and non-science students
- Varied instructors
- Perception of internal cohesion

Curricular Topics – pre2009

Scientific method

Greek Cosmology – Geocentrism

Heliocentrism

Popper and Falsification

The Scientific Revolution and Paradigm Shifts

Big Bang Cosmology

Biological Paradigms – Darwin

Technology, Society and Ethics

Scientific Thinking: Student Focus

- Collaborative restructuring
- Reordering and focusing around relevance
  - BEGIN with self
  - MOVE OUT to universe
- Topic flow matches cognitive growth

Curricular Topics – 2009

Scientific method

Science and Pseudoscience

Technology, Society and Ethics

Biological Paradigms – DNA to Darwin

Origin of Life

Origin of Solar System

Big Bang Cosmology

Our Place in the Universe

Teaching Scientific Thinking

Students

- 600 per semester
- 20 sections
- first/second year
- undeclared; desiring business or engineering program

Instructors

- 13-15 per semester
- biologists
- chemists
- physicists
- philosophers of science
- historians of science

Providing a Common Experience: Utilizing Strengths

- General Lecture Series
- weekly lectures attended by all sections
- all students guided through the curricular topics
- general lecturers are experts in their fields

Curricular Topics – 2009

Scientific method

Science and Pseudoscience

Technology, Society and Ethics

Biological Paradigms – DNA to Darwin

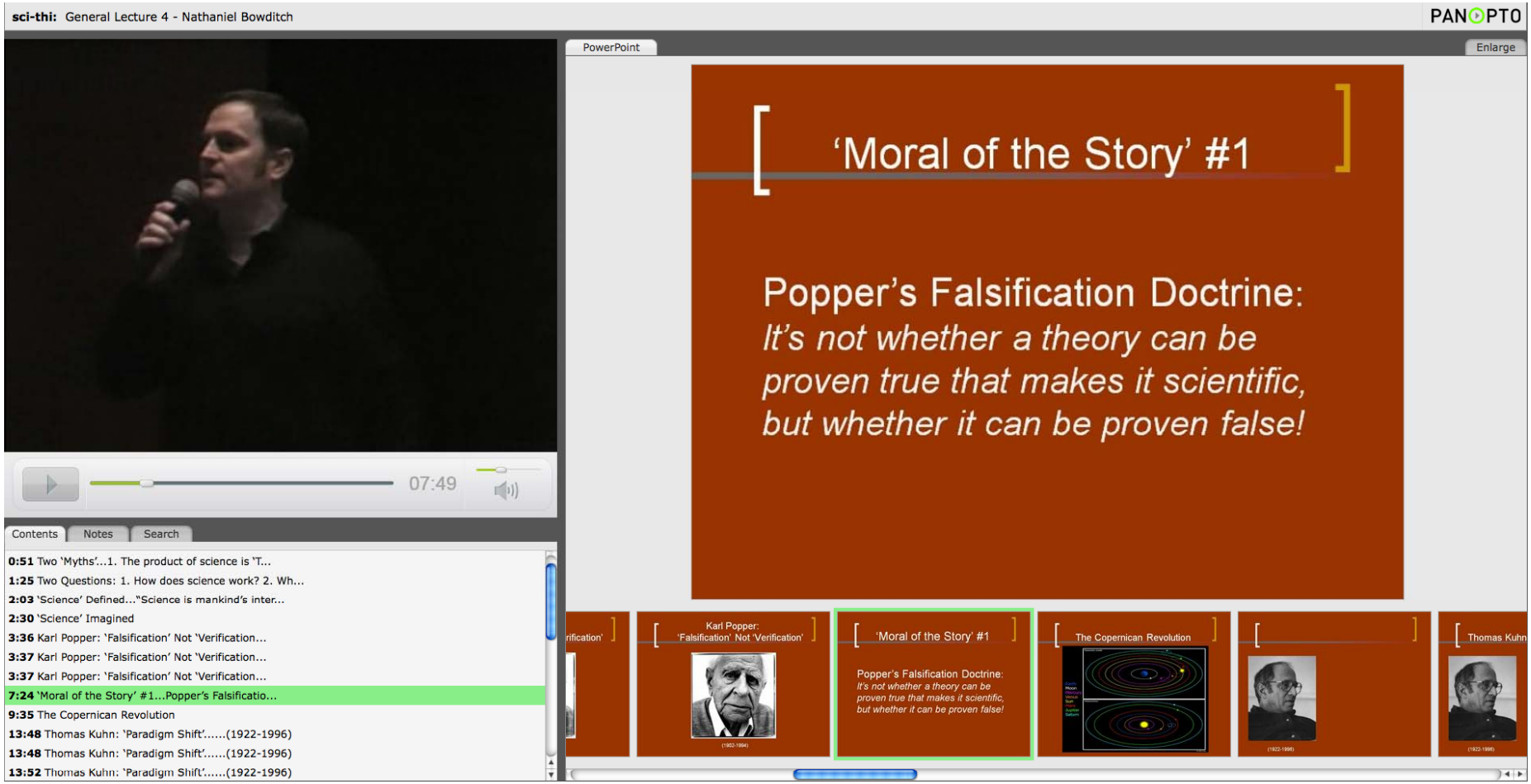
Origin of Life

Origin of Solar System

Big Bang Cosmology

Our Place in the Universe

General Lecture Series: using technology to extend the role



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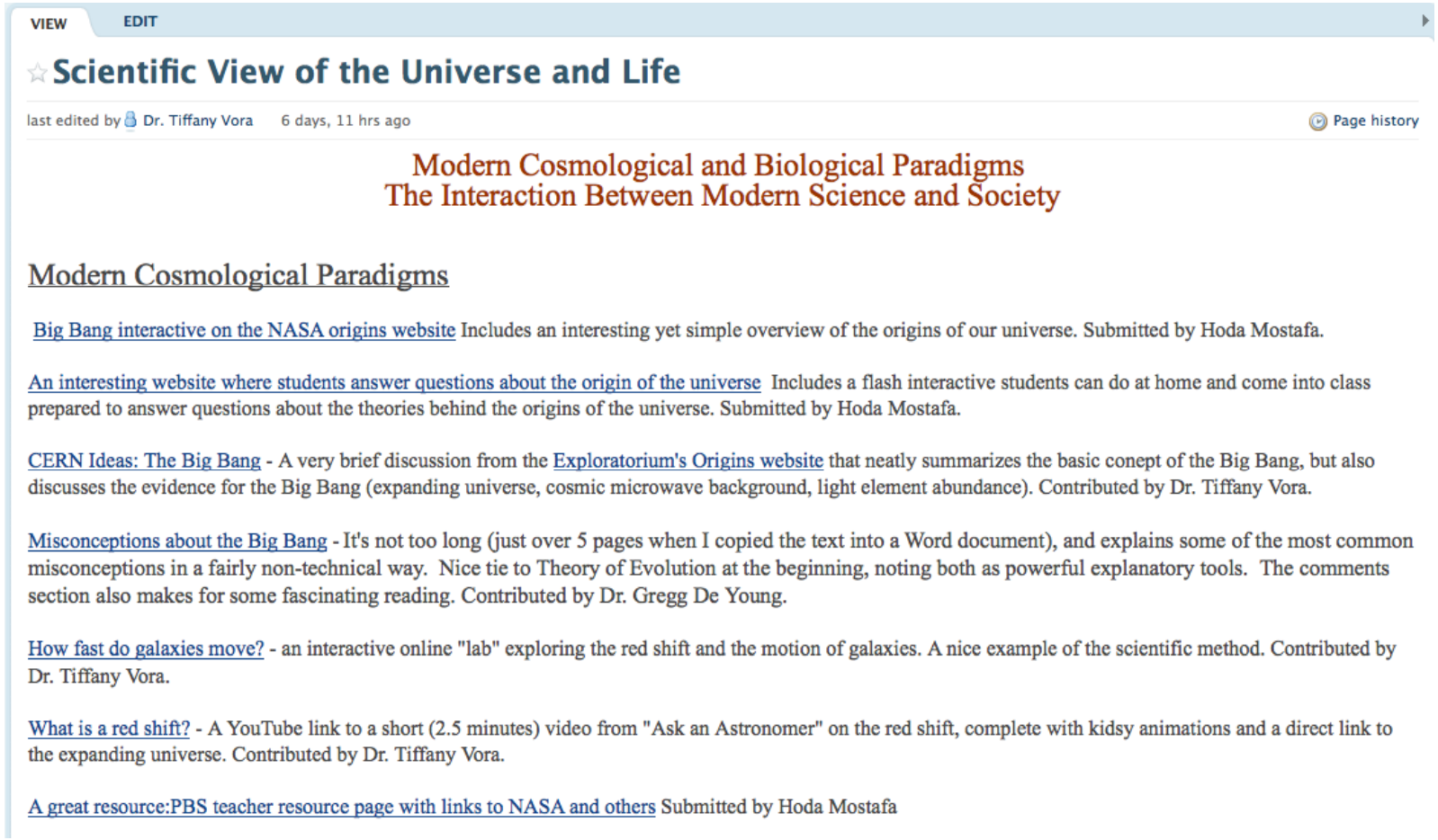
Providing a Common Experience: Utilizing Strengths

- ongoing instructor collaboration
- weekly workshops – what works and what does not
- actively updated resource repository

Providing a Common Experience: Utilizing Strengths



VIEW EDIT

Scientific View of the Universe and Life

last edited by Dr. Tiffany Vora 6 days, 11 hrs ago Page history

Modern Cosmological and Biological Paradigms
The Interaction Between Modern Science and Society

Modern Cosmological Paradigms

Big Bang interactive on the NASA origins website Includes an interesting yet simple overview of the origins of our universe. Submitted by Hoda Mostafa.

An interesting website where students answer questions about the origin of the universe Includes a flash interactive students can do at home and come into class prepared to answer questions about the theories behind the origins of the universe. Submitted by Hoda Mostafa.

CERN Ideas: The Big Bang - A very brief discussion from the Exploratorium's Origins website that neatly summarizes the basic conept of the Big Bang, but also discusses the evidence for the Big Bang (expanding universe, cosmic microwave background, light element abundance). Contributed by Dr. Tiffany Vora.

Misconceptions about the Big Bang - It's not too long (just over 5 pages when I copied the text into a Word document), and explains some of the most common misconceptions in a fairly non-technical way. Nice tie to Theory of Evolution at the beginning, noting both as powerful explanatory tools. The comments section also makes for some fascinating reading. Contributed by Dr. Gregg De Young.

How fast do galaxies move? - an interactive online "lab" exploring the red shift and the motion of galaxies. A nice example of the scientific method. Contributed by Dr. Tiffany Vora.

What is a red shift? - A YouTube link to a short (2.5 minutes) video from "Ask an Astronomer" on the red shift, complete with kidsy animations and a direct link to the expanding universe. Contributed by Dr. Tiffany Vora.

A great resource:PBS teacher resource page with links to NASA and others Submitted by Hoda Mostafa

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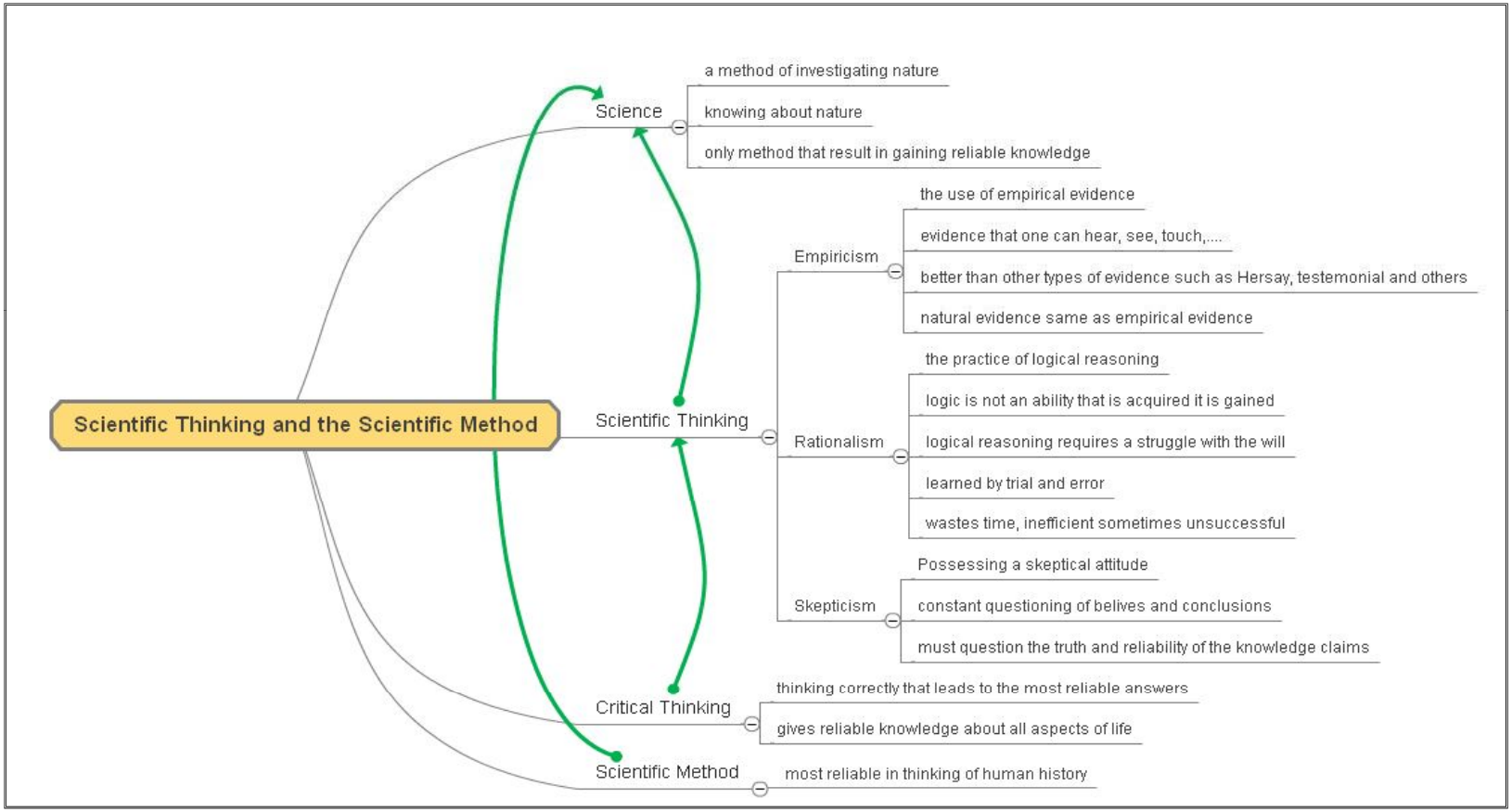
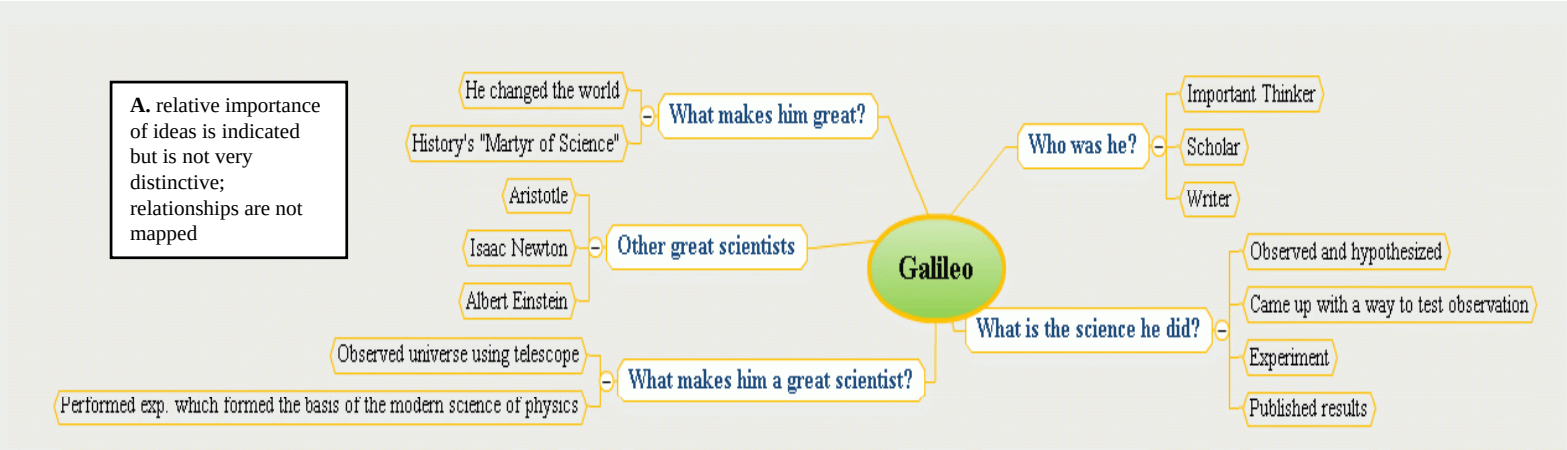
Developing scientific and critical thinking through an active learning/technology enhanced environment

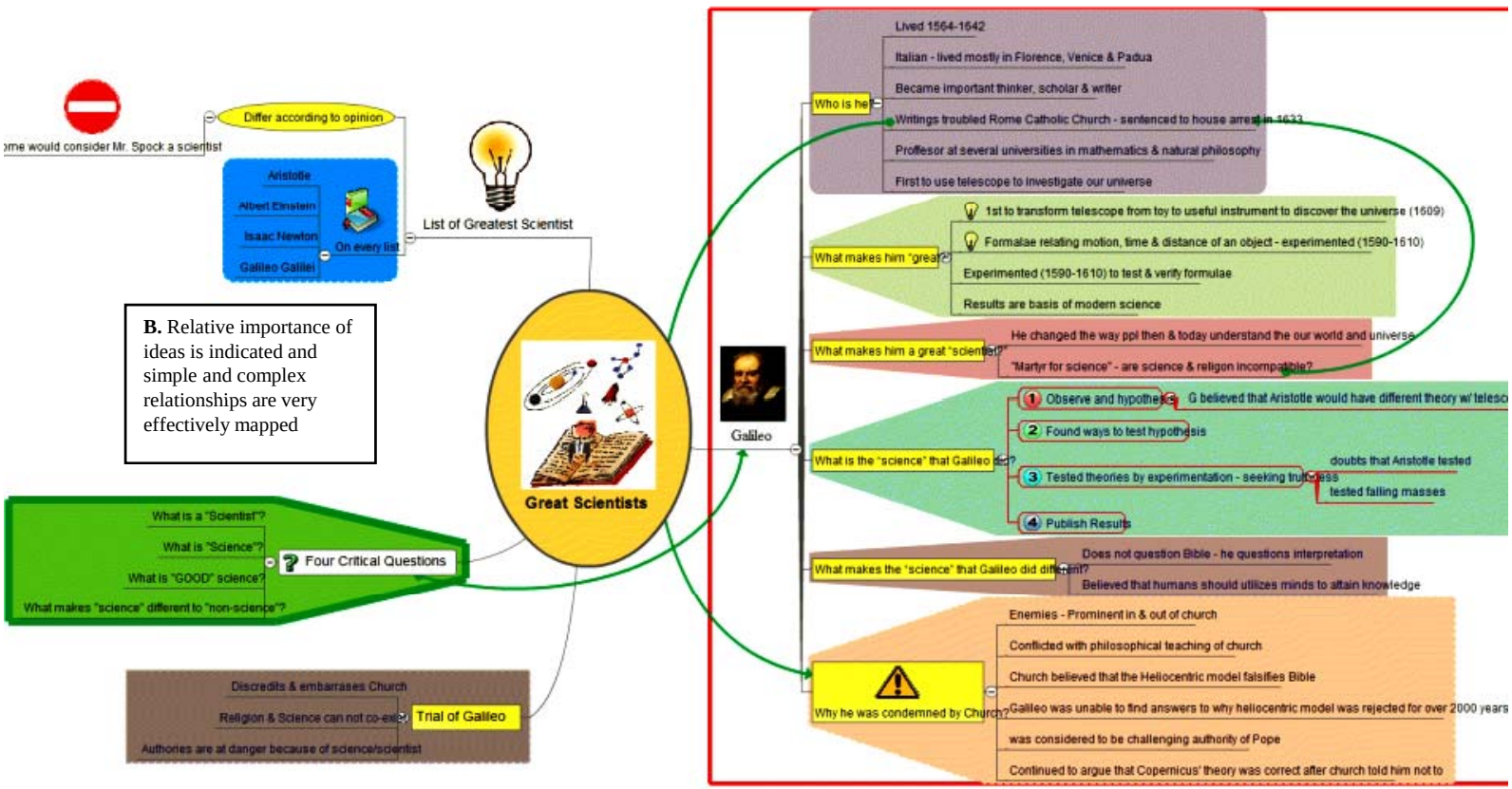
Active learning with e-maps



Student e-maps of a lecture presentation



❖ Student has to convert linear text to a non-linear graphic represen-tation

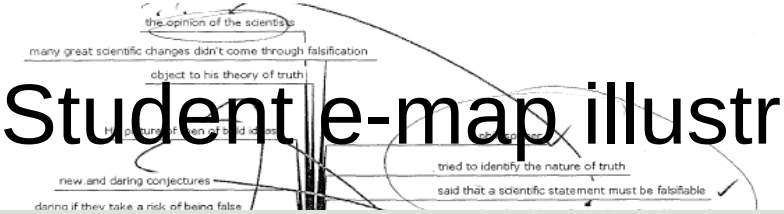


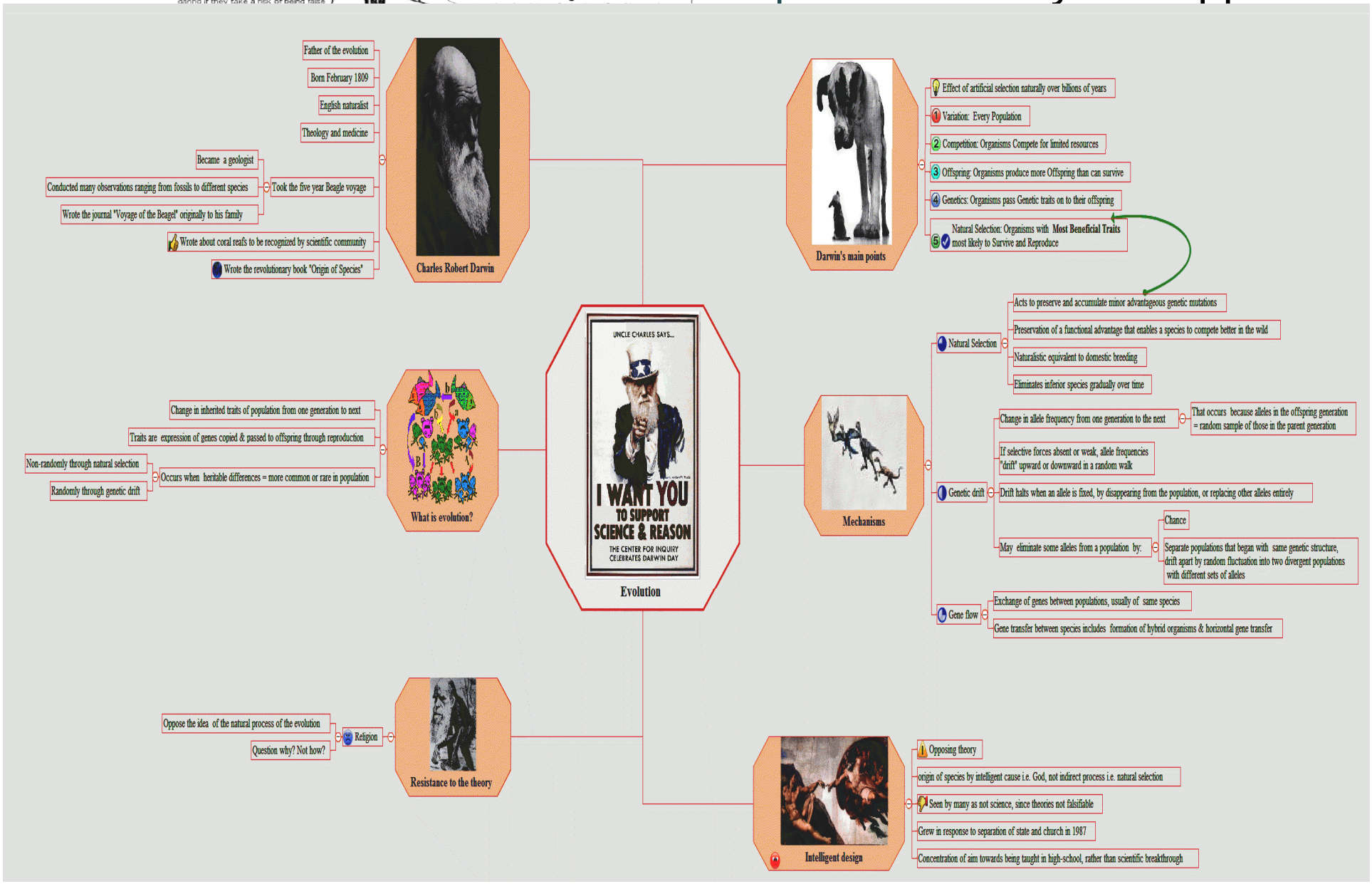
❖ No two maps can ever be the same

❖ E-maps are a window into students' "thinking"

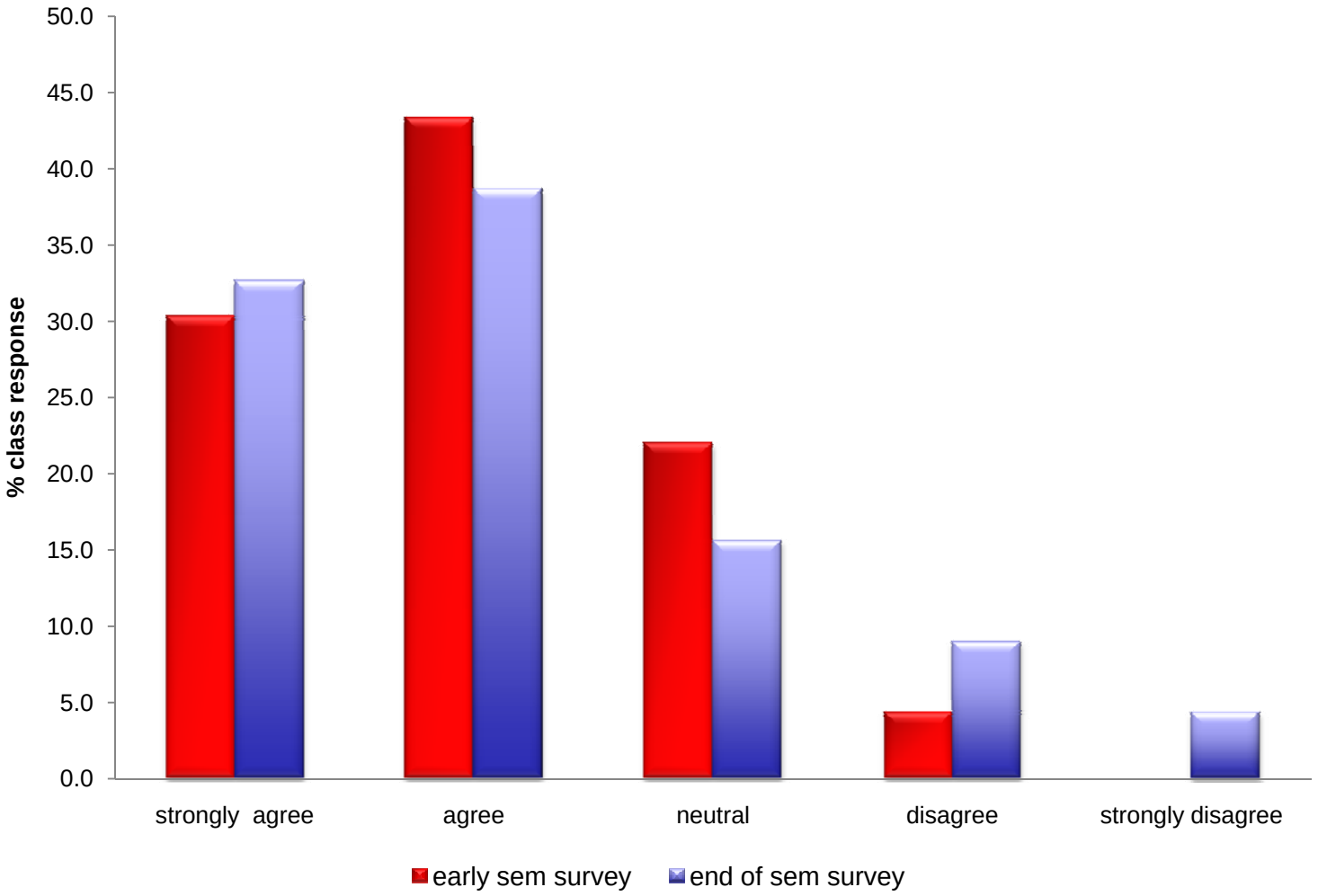
Student e-map illustrating synthesis skills

Student e-map of an article by K. Popper:





Concept mapping required me to look at the reading in more depth



Web 2.0 Technologies

Multimedia

Blogs

Wikis

Social networking

Collaborative technologies

Student products

last edited by Allia Shahin 4 months, 3 weeks ago Page history

SCIENCE AS WE KNOW IT TODAY

http://evolution.berkeley.edu/evosite/nature/images/oldandnewscientists.gif [1]

Sidebar

You can navigate through the pages from here

Start Page
Aristotle and Ptolemy
Copernicus (1473-1543 AD)
Brahe and Kepler
Galileo
Newton (1642-1727 AD)
Bibliography

Notebook
SideBar

What is Science and why is it important?

Science for many people represents a set of facts and theories that explain nature or a course at school containing physics and chemistry. However science is a method to help us come up with theories to explain the Universe around us. If we didn't have science we wouldn't have the tools that help us track time, predict the calendar, know medicine, we wouldn't have the luxuries of technology, movies, iPods and above all we wouldn't be able to explain the things we observe in the world.

Wiki : meta-content

Collaborative **comments** function

Gina Aziz said
at 5:06 am on Oct 23, 2008
Delete

hi again, sorry but i have one morething to say. it is just an idea, you don't really have to do it.
i was thinking that you can say that one of the possible recent interpretations of why people did not believe in the heliocentric model was the Ockham's razor. Obviously, at that time, people believed geocentrism is right and simpler. You see what i say??

Omar Amer said
at 1:53 am on Oct 22, 2008
Delete

just a question guys does anyone know what is meant by a static earth ?? ??????

Logine Abdalla said
at 11:27 pm on Oct 22, 2008
Delete

a static earth is when the earth is unchanging... but do you mean a static earth or a static UNIVERSE?

Further Discussion

1. Are wikis an appropriate tool for rigorous collaborative academic work?
2. Do students and professors share common expectations for technology integration?
3. What additional information is needed to update traditional learning methods?