## Lesson 2 Intellectual Revolutions that Defined Society

## COURSE MATERIALS

### What is an Intellectual Revolution?

When the new ideas oppose the widely embraced and accepted beliefs by the people, paradigm shifts occurs, resulting to intellectual revolution. Several times, this new ideas caused chaos to the society, long periods of argument and disbelief, before the new ideas are accepted by the people, often times, it require other scientists to verify and support the theory or find a concrete proof to verify and validate the proposed idea.

Some of the scientist who presented their revolutionary ideas were Nicolas Copernicus, Charles Darwin and Sigmund Freud.

### COPERNICAN Intellectual Revolution

Nicolai Copernicus Published his treatise *De Revolutionibus Orbium Coelestium* (the Revolution of Celestial Spheres) in 1543, He proposed a new view of the world: the Heliocentric Model where the sun is the center of the solar system and not the earth as Ptolemy's geocentric view. Heliocentric model challenged the age long views of the way the universe worked, and initially the model was condemned by the Church authorities. The model attracted many critics and the system was soon accepted by the best minds of the time including Galileo. The model was improved by scientist like Giordano Bruno who proposed that "the universe is infinite containing many worlds like ours where intelligent beings live," and Thomas Digges who assert that "the stars are dispersed throughout the universe." Johannes Kepler in 1600 proposed the orbits were instead ellipse.

Readings: The Copernican Revolution
Retrieved from: https://users.astro.ufl.edu/~freyes/classes/ast1002/Ch1.pdf

### DARWINIAN INTELLECTUAL REVOLUTION

Charles Darwin's theory of evolution by natural selection caused intellectual ferment in mid- and late Victorian England. His book "*The Origin of the Species (*1859) cast strong doubts on the traditional belief in the origin of life, also promoted a sharp reorientation of philosophical and moral attitudes. Darwin's theory of evolution thereby undermined the value of traditional religion and morality because it implied that man was no more than a "talking monkey", and no God was necessary to create him. Darwin's theory of evolution appealed not only to eminent scientists, but also to novelist and poets.

Many Victorian writers dramatically modified their opinions about man's origins and the physical aspect of man's existence. Thomas Hardy, were close readers of Darwin's work, adapted Darwin's ideas to his later fiction showing characters to be at the mercy of their environment, heredity and adaptability rather than more in control of fate. An intellectual ferment caused by the evolutionary theory led to an ongoing controversy over religion and science.

Readings: The Darwinian Revolution: Rethinking its meaning and significance Retrieved from: http://www.blc.arizona.edu/courses/schaffer/449/Ruse%20-%20The%20Darwinian%20Revolution.pdf

## FRUEDIAN INTELLECTUAL REVOLUTION

Sigmund Freud was an Austrian neurologist and the founder of PSYCHOANALYSIS, a clinical method for treating psychopathology. Freud developed the psychoanalytic theory of personality development, which argued that personality is formed through conflicts among three fundamental structures of the human mind: the id, ego, and the superego. One of Freud's assertion is that we are not masters of our own mind. He showed that human experience, thought, and deeds are determined not by our conscious rationality, but by irrational forces outside our conscious awareness and control. The primary trouble with Freud is that, while his ideas appear intriguing and even common cynical, there's very little evidence to back them up. There's no proof of the id, ego, or superego.

Readings: Psychoanalysis: A Brief History of Freud's Psychoanalytic Theory
Retrieved from https://positivepsychology.com/psychoanalysis/

## CRADLES OF EARLY SCIENCE

### Development of Science in MESOAMERICA

The Aztecs, Maya, and Inca developed great civilizations in Mesoamerica about 2100BC to 500BC. Each Group is unique and shows an effective way of running an empire.

Mathematics was used:
Mayans – used vigesimal number system (base 20)
Aztecs – used geometry for taxes
Incas – used quipu (knots from strings)

Technology:
Mayans- discovered rubber; used jadeite for many sort of tools
Incas – built large stone buildings without mortar; farmers used to **terraces** to maximize crops
Aztecs - invented **canoes**, **wheel**; and have many medical advances

Astronomy:
Mayans – predicting eclipses, astrological cycles, used 2 calendars in planting and harvesting
Incas – used calendar with 12 months
Aztec – used calendar with 365 days and 260 days; calculates the end of the world in December 21, 2012

Architecture: all three civilizations built temples
Aztecs – Areas dedicated to certain gods
Mayans – Ball courts
Incas – temples made to assist worship to gods; first suspension bridge

Art
Aztecs – told stories through sculptures, pottery, weaving and poetry
Mayans – Sculptures and paintings depicts religious figures, scenes of battles and sacrifices
Incas- utilized stone masonry and textiles
Literature
Aztecs – they spoke language called **Nahualt**
Mayans – writing systems consisting of 800 symbols called **glyphs** standing for words and letters

Incas – never developed writing system, instead memorize important information. They spoke Quechua

Infrastructure
Aztecs – had aqueducts; mandatory education
Mayans – advance water systems; control floods and survive drought
Incas – road system

**Development of Science in ASIA**

Printing started in China in 593 AD. Printing was promoted by the spread of Buddhism. Printing in East Asia evolved from ink rubbings made o paper or cloth from text on stone tables. The invention of paper, gunpowder, compass, sundial, water clocks and surgery using acupuncture were some of the main accomplishments of Han Dynasty (202 B.C.E -220C.E.). Confucianism is a system of social and ethical philosophy built on an ancient religious foundation to establish the social values, institutions, and transcendent ideals of traditional Chinese society. Confucianism's role in the private learning spheres of early Japanese society directly impacted scientific thought.

INDIA. Indians came up with two very valuable concepts that simplify math: place value digits and zero. Equipped with Indian place value, Aryabhata, developed trigonometry, place value system and the approximation of pi. He also explained solar and lunar eclipses scientifically, and stated that the moon and the planets shine by reflecting sunlight. Brahmagupta, defined the properties of the number zero. He also suggested that gravity is a force of attraction. India is also known for manufacturing iron and in metallurgical works. In the field of medicine they use Ayurveda, a treatment based on a delicate balance between the mind, body and spirit, to promote good health.

**Development of Science in the MIDDLE EAST**

Greek texts were translated to Arabic, this led to excellent Greek base knowledge and the Arabs made their own advances in the fields of Mathematics, Medicine, and Physics. Islam and the rise of Arab empire affected Arab math and Science in two ways: 1.Muslim culture remained open to Ancient Greek learning. The rise of empire directly exposed the Arabs to Byzantine (modern-day Istanbul) and Persian cultures that still carried on ancient scholarships. Hasan Ibn al-Haytham an Arab mathematician, astronomer, and physicist known as the father of Optics. Muhammad ibn Musa al-Khwarizmi, contributed the concept of the algorithm in mathematics, calendars, calculating true positions of the sun, moon and planets, tables of sines and tangents, spherical astronomy and astrological tables

**Development of Science in AFRICA**

Ancient Egyptian physicians were renowned for their healing skills. In 1285, the largest hospital of the middle ages and pre-modern era was built in Cairo. Ethiopians, were the first to have discovered and recognized the energizing effect of coffee bean plant. Domestication of plants for agricultural purposes in 5000BCE. Sorghum and African rice began to be cultivated.
**Caesarean sections** were performed on a regular basis with the use of **antiseptics**. Max Theiler, a South African, developed a vaccine against Yellow fever in 1937. The first human-to-human heart transplant was performed by South African cardiac surgeon Christian Barnard, in Dec 1967.

**Readings:**
Cradles of Early Science. Accessed from:
https://www.scribd.com/document/423753973/Cradles-of-Early-Science-docx

**Lesson 3 Science and Technology in Nation Building**

**COURSE MATERIALS:**

**a. The Philippine government S&T agenda**

From the previous lesson, we have seen how science and technology progress in the Philippines. From the pre-Spanish period when our ancestors gradually learn from their everyday experiences, to the introduction of new knowledge by the Spaniards, Americans, development of Science and technology facilities and programs. Why do we have to promote science and technology in our country? Through science and technology we can boost our economy, and to prepare the country and the people to cope with the demand of the technologically driven world.
What are the Philippine government's policies on science and technology?
The Department of Science and Technology (DOST), commissioned the National Research Council of the Philippines (NRCP) to consult different sectors and came up with 4 clusters of policies, these are:

1. Social Sciences, Humanities, Education, International Policies and Governance
   - Integrating ASEAN awareness in basis education without adding to the curriculum
   - Emphasizing teaching in the mother tongue
   - Developing social infrastructure and providing for ICT broadband
   - Local food security
2. Physics, Engineering and Industrial Research, Earth and Space Sciences, and Mathematics
   - Emphasizing degrees, licenses, and employment opportunities
   - Outright grants for peer monitoring
   - Review of R.A. 9184
   - Harnessing science and technology as independent mover of development
3. Medical, Chemical, and Pharmaceutical Sciences
   - Ensuring compliance of drug-manufacturing firms with ASEAN-harmonized standards by full implementation of the Food and Drug Administration
   - Creating an education council dedicated to standardization of pharmaceutical services and care
   - Empowering food and drug agencies to conduct evidence-based research as pool of information
   - Allocating two percent of the GDP to research
   - Legislating a law supporting human genome projects
4. Biological Sciences, Agriculture and Forestry
   - Protecting and preserving biodiversity by full implementation of existing laws
   - Use of biosafety and standard model by ASEAN countries
   - Promoting indigenous knowledge system and indigenous people's conservation
   - Formulation of common food and safety standard

The Philippine congress has also created various laws related to science and technology according to different themes like: conservation, health-related, technology building, and supporting basic research. All these policies ensure that the whole country and all people will experience the progress that science can bring.

**b. Major development programs and personalities in S&T in the Philippines**

**DOST's programs encourage researches in the field of:**

1. Use of alternative and safe energy
2. Harnessing mineral resources
3. Find cure to various diseases and illness
4. Climate change and global warming
5. Increasing food production
6. Preservation of natural resources
7. Coping with natural calamities and disasters
8. Infrastructure development

The DOST headed by Secretary Fortunato Dela Pēna, together with Undersecretary for Scientific and Technical Services and OIC for Disaster Risk Reduction and Climate Change Dr. Renato Solidum Jr., Under Secretary for Research and Development Dr. Rowena Cristina Guevara, Under Secretary for Regional Operations Ms. Brenda Manzano and other personalities of the department continues to encourage Filipino scientists or scientists of Filipino descent to return to the Philippines to share their expertise to strengthen the scientific and technical human resources of the academe.

**Some of the outstanding Filipino Scientists who have made significant contributions in the Philippine science includes**:

William Padolina - chemistry and president of National Academy of Science and Technology (NAST) Philippines
Edgardo Gomez – Famous in Marine Science
Caesar Saloma – internationally renowned physicists
Ramon Barba – for his outstanding research on tissue culture in Philippine mangoes
Josefino Cacas Comiso – for his works on observing the characteristics of Antarctica by using satellite images
Fabian Dayrit – for his research on herbal medicine
Rafeal Guerrero III – for his research on *tilapia* culture

There are other scientists in the Philippines who were in the listed or recognized they are what we call backyard scientist. Yet, we still need more scientists and engineers to support scientific research in the country.

**c. Science Education in the Philippines**

The University of the Philippines Los Baños is the science paradise for agriculture, forestry, plant and animal science, and veterinary science. The University of the Philippines Visayas is the center for marine science, fisheries, and other related sciences. The University of the Philippines Manila is a center of excellence and has produced many researchers, doctors, health professionals, and scientists in the area of medical and public health. The University of the Philippines Diliman has established a national science and engineering complex to develop more research and produce more scientists and engineers in the country.

**The Philippine government through the DOST have ongoing projects on:**

- Funding basic researches and patents related to S&T

- Scholarships for undergraduate and graduate studies of students in the field of science and technology.
- Establishing more branches of the Philippine Science High School system
- Creating S&T parks to encourage academe and industry partnerships
- Establishment of the National Science complex and National Engineering complex and within UP Diliman campus, to encourage more research in the said fields
- The current K to 12 education program included Science, Technology, Engineering and Mathematics or STEM as one of the major tracks in Senior High School to encourage more students to enroll in science-related fields in college.

**d. Selected indigenous science and Technology**

Indigenous science are local knowledge based on culture developed over centuries and passed on from generations to generation. These knowledge are based on experimentation and experiences of our ancestors, and was proven to be effective scaffold to sustainable development connecting the past, the present and the future. Some examples of indigenous knowledge are:

- Predicting weather conditions and seasons based on observation of animal behaviors and celestial bodies
- The use of herbal medicines
- Methods of preserving food using salt, and others
- Selecting good seeds for planting
- Producing wines and juices from tropical fruits
- Building local irrigation systems like terracing
- Classifying different types of soil for planting based on cultural properties
- Keeping the custom of growing plants and vegetables in the yard

Indigenous science is important in the development of S&T in the Philippines, it helped people in understanding the natural environment and copping with everyday life. Until the present times, many rural communities still adhere to the use of indigenous knowledge due to the inaccessibility of modern day technology in their area.

**ACTIVITIES/ASSESSMENT**

**ACTIVITY/ASSESSMENT**

1. Which cradle/s of early science do you consider had the greatest influence in our society today? Explain your answer.

Watch the video following the link below, then answer the questions below:
Video: Smarter Philippines DOST
https://www.youtube.com/watch?v=_jICN2IKKJg&t=180s

2. How would the DOST want to improve the lives of the Filipinos?
3. Write an assessment on how the latest program or project of the government on science and technology would affect you and the ordinary Filipino.