

The educational innovation of the online age, what should we start with?

Hee-chan Lew hclew@knue.ac.kr

2nd UNITWIN Conference of
Korea National University of Education
December 16, 2020

Two Social Changes and Education

- Recently we have faced two major social changes.
- An epochal change in work life to shift from collective service to teleworking
- Fourth Industrial Revolution to transform the industrial society as a whole into a convergence-based high-technology system
- What is the direction education should go in the face of these social changes? Today's presentation highlights **innovation in textbooks and teacher education** as the starting point that should be addressed.

On-Line Period

- The Corona virus has been raging around the world for nearly a year.
- The invisible virus is changing our daily lives too much.
- Beyond economic difficulties it has created, the practice of “working life” is changing into a non-face-to-face on-line home-based style.
- The on-line period is opening up.



On-line education

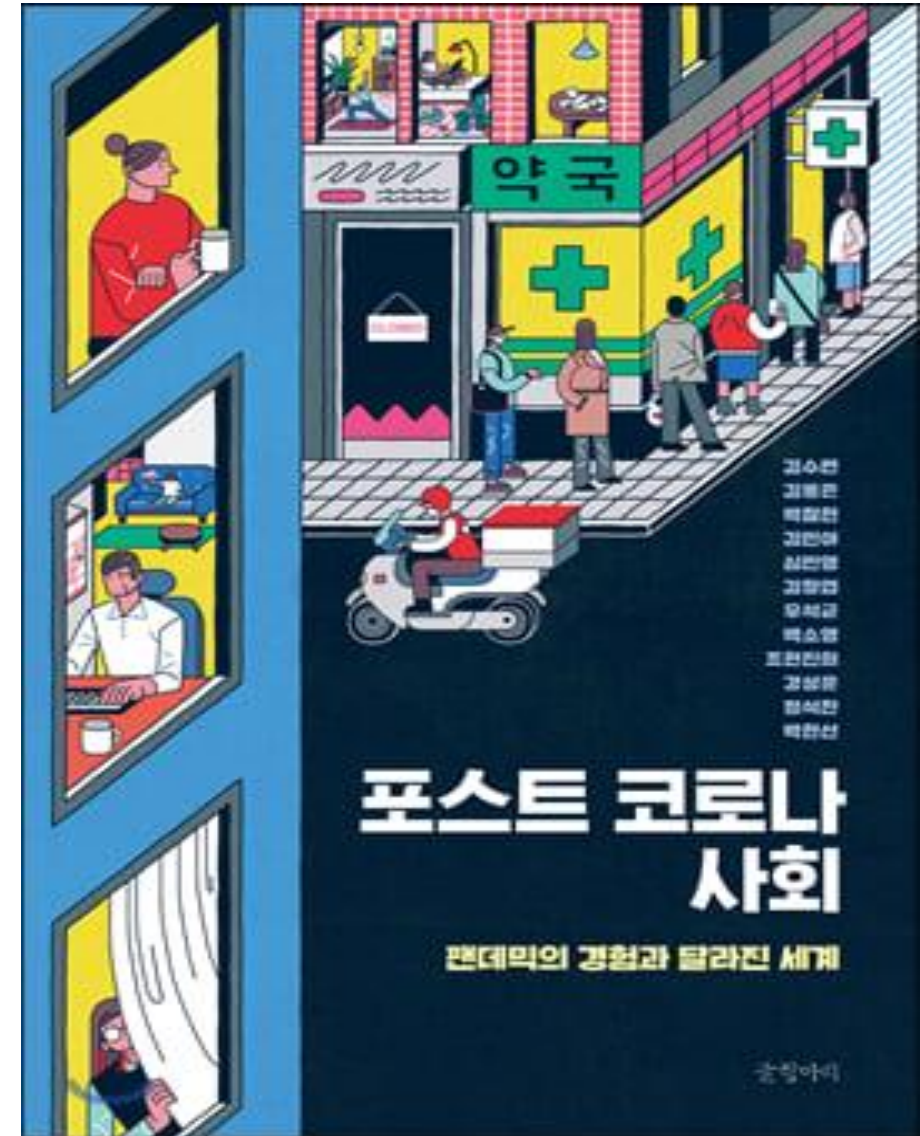
- Even in education, non-face-to-face remote education through **online** is becoming **a trend**.
- **The problem** is that results of **on-line learning** are very different depending on many factors like teacher's ability and student's home and ICT circumstance etc.
- We have recently found it extremely difficult to maintain the quality of public education online.



Education in Post-Corona Period

- More concern is that the Pandemic might be longer and we should coexist with viruses.
- **On-line education** might be inevitable part of our public education in the long term point of view.
- So, we have to design **innovation of on-line education** with a very careful and systematic approach as soon as possible.

Post-Corona Society



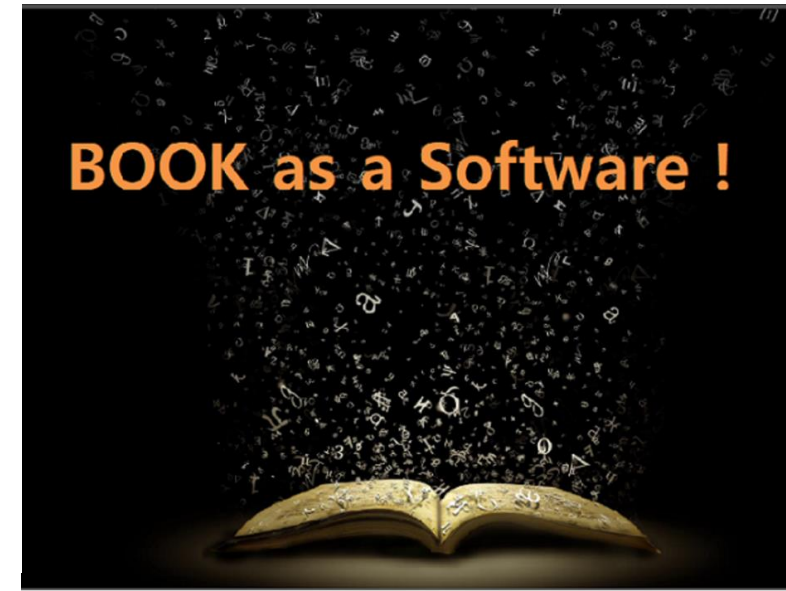
Innovation of On-line education

- Innovation of online education should take place in many aspects, but the most urgent issue lies in building a learning environment that makes online education "fun and meaningful" for students to focus on learning.
- This issue is very important even in face-to-face classes, but it is more important in the online classes.
- That is why innovation should start with new teacher education



Intelligent Adaptive Learning System

- Innovation of **on-line** education needs an “**intelligent adaptive learning system**” for environment that transcends time and space to receive quality classes at any time.
- Developing a **digital textbook** linked with various learning materials and **qualifying teacher education** are starting points to drive forward the intelligent adaptive learning system for activating on-line education.



Textbook as a main material

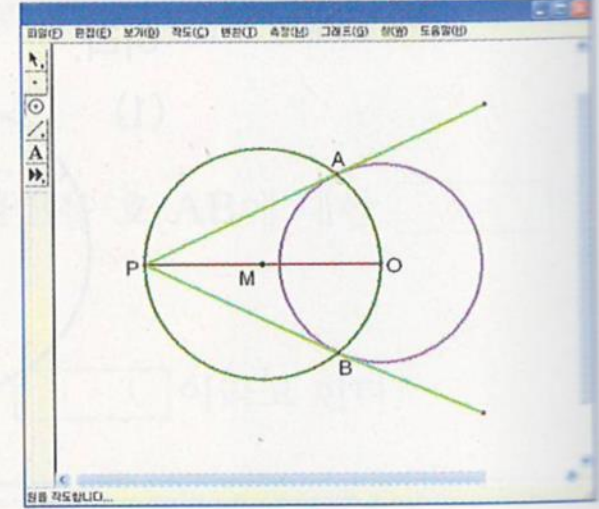
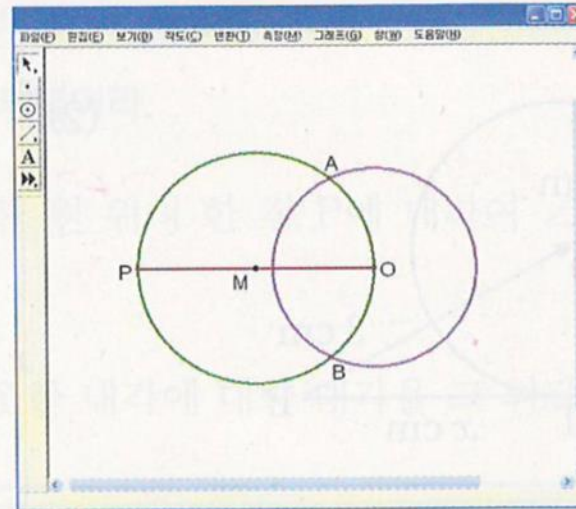
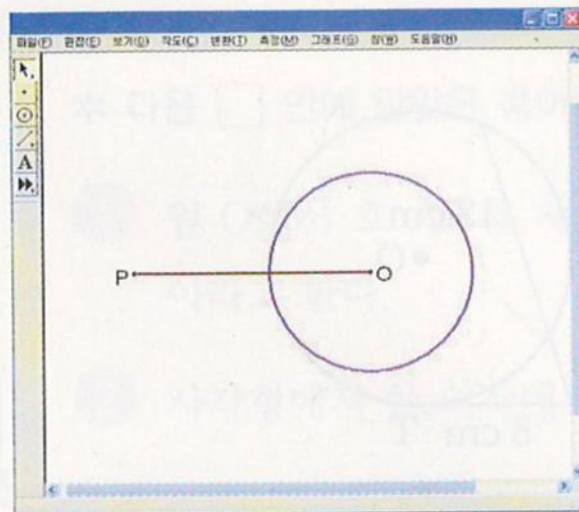
- Why a digital textbook is emergent in the revolutionary age?
- A **paper** "textbook" has been central in educational tradition as **a** "main material" for teachers throughout the world.
- This means that if "**well organized digital textbooks for online education**" can be made, they can guarantee at least a certain amount of educational effectiveness even in the Pandemic situation.



Why a digital textbook?

- Meanwhile, a paper textbook is a main culprit to make classroom environment passive because it basically does not induce a meaningful enquiring process by students themselves even though it shows sometimes "computer-related procedure" for students to just follow.

"Draw a tangent line of Circle O through point P"

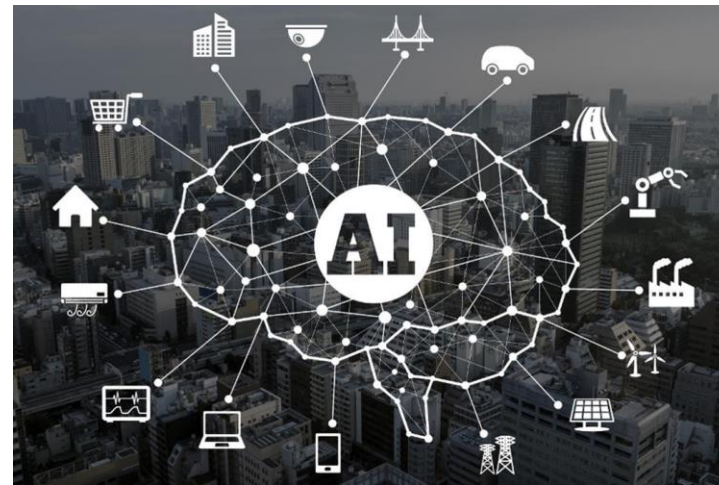
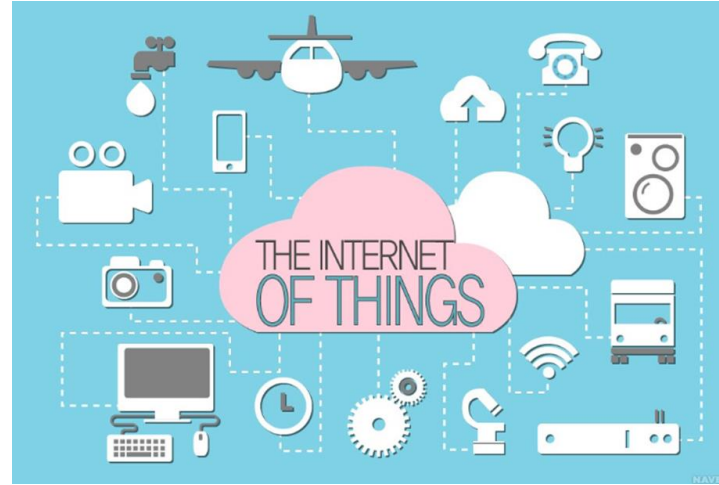


Key elements of a Textbook Innovation

- The key elements for textbook innovation should be operation and connection.
- To learn concepts well and interestingly, students need a chance to explore to find concepts spontaneously based on their direct concrete **operation or manipulation**.
- To make learning meaningful, students need to experience **connection** or **convergence** between learning and ordinary life or other subjects.
- These elements induce **dynamic interdisciplinary textbooks** which function well in **intelligent adaptive learning system**.

New Education for the Fourth Industrial Revolution

- Another factor driving social transformation is the **Fourth Industrial Revolution**.
- The Revolution refers to an industrial change based on a "**virtual physical system**" intelligently controlled through a high-speed network called 5G.



Virtual physical system: IoT, VR, AI, Self-driving Car

Rapid Society Change

- The characteristic of the fourth industrial society is that change is too fast.
- It is already entering the 5th industrial society where cooperation between humans and machines is more emphasized.
- Now we need a new education that can continue to lead these social changes.
- What should be the key to the new education?

1.0



1780 – Mechanisation

Industrial production based on machines powered by water and steam

2.0



1870 – Electrification

Mass-production using assembly lines

3.0



1970 – Automation

Automation using electronics and computers

3.5



1980 – Globalisation

Offshoring of production to low-cost economies

4.0



Today – Digitalisation

Introduction of connected devices, data analytics and artificial intelligence technologies to automate processes further

5.0

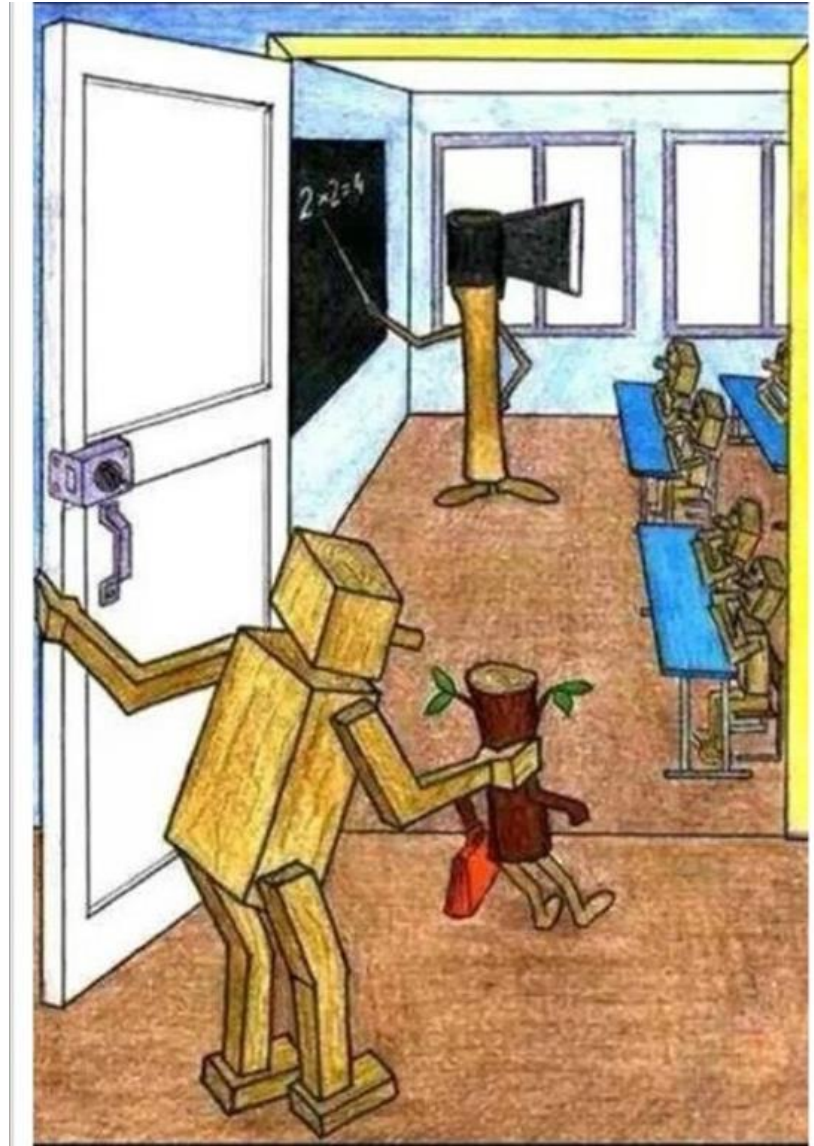


Future – Personalisation

The fifth industrial revolution, or Industry 5.0, will be focused on the co-operation between man and machine, as human intelligence works in harmony with cognitive computing. By putting humans back into industrial production with collaborative robots, workers will be upskilled to provide value-added tasks in production, leading to mass customisation and personalisation for customers

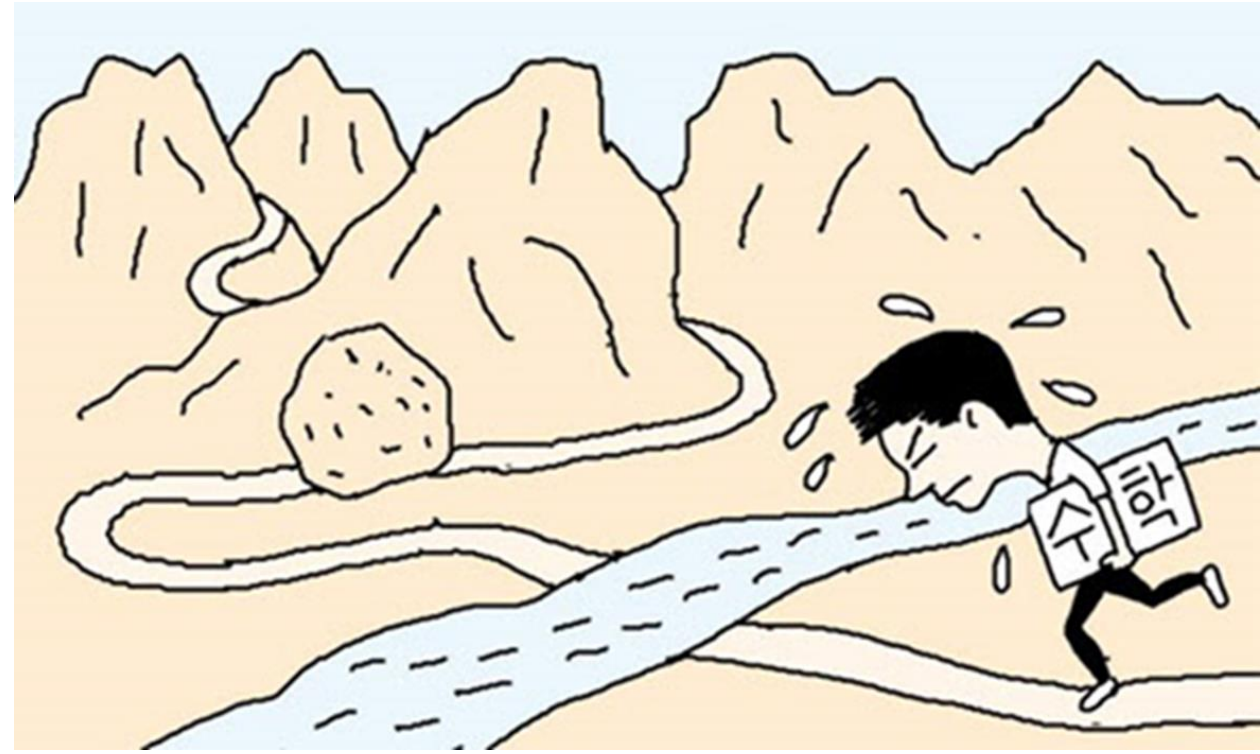
Uniform Education: Crisis

- Uniform education to teach basic knowledge and skills necessary to manage mass production systems in the 1960s and 1970s should no longer continue.
- The education cannot consider the characteristics of individual students by preventing them from a fun, meaningful and creative education necessary to develop their dreams and talents.
- The education creates a great danger for the future society.



Loss of interest and meaning

- Uniform education, which was suitable for the Third Industrial Revolution, still takes place during even the Fourth Industrial Revolution, when creative thinking is the most important.
- The result is the loss of interest and meaning of students.
- This is why there are so many SUPOJA, which means students who hate or give up school mathematics despite studying hard in mathematics.



All educational societies should awake!!

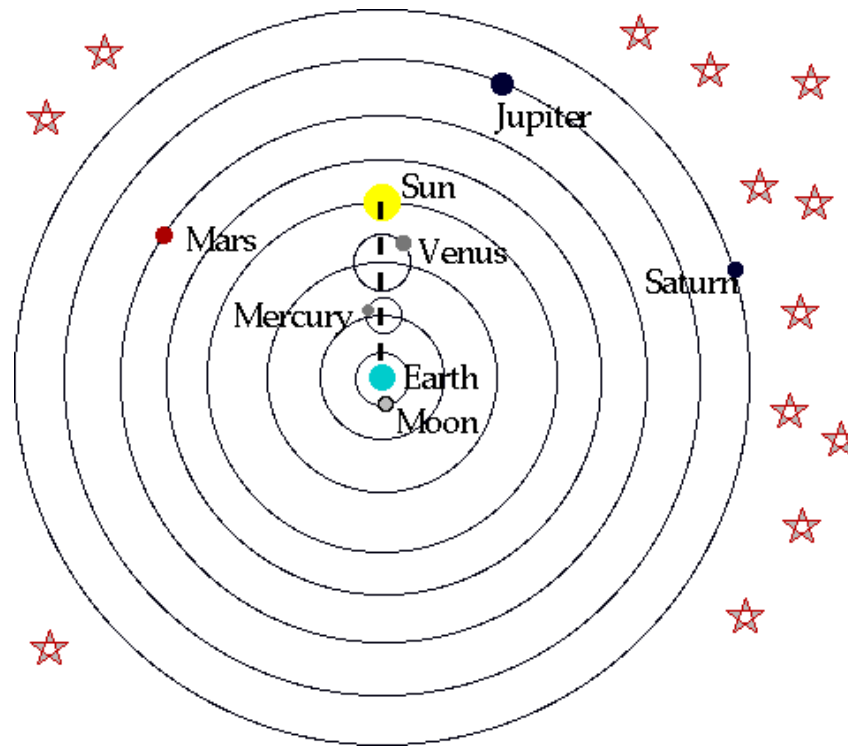
Current education is driving students into the box.

- Students are suffocating in the box.
- In this situation, it is absolutely not possible to develop students' "dream and talent" for their future.
- All educational societies should awake **methodologically** and **epistemologically** about what to do and how to do change **the educational system in the social changes**.



Dynamic Interdisciplinary Textbook (Connection of mathematics and science for 9th grade)

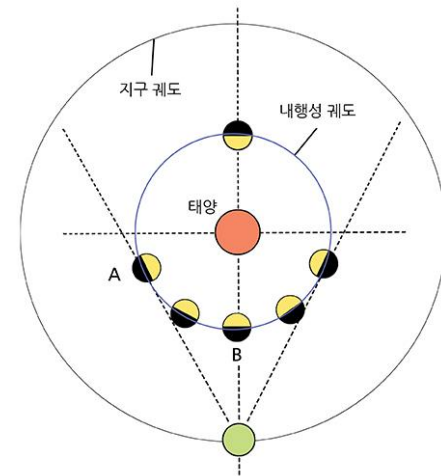
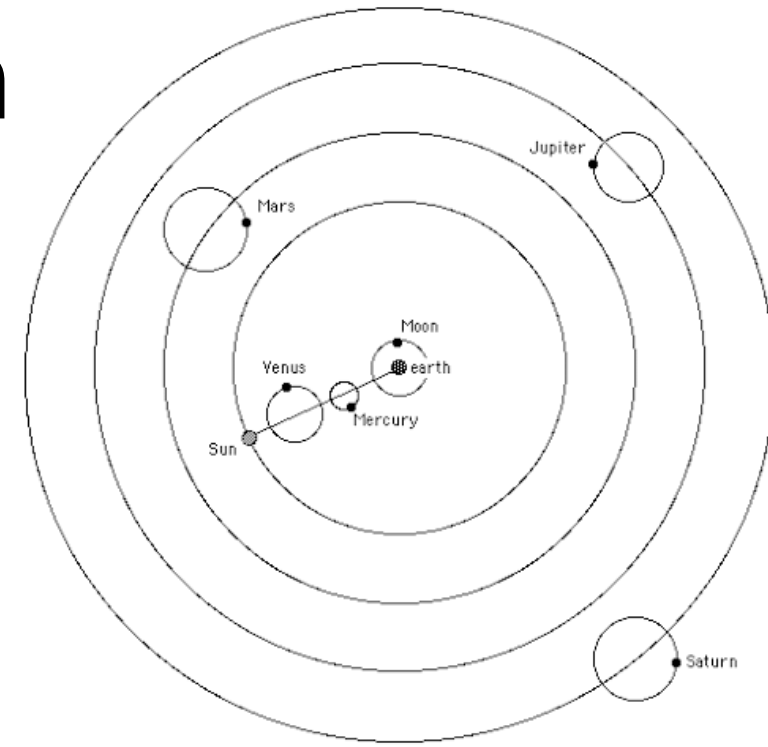
- Geocentrism confirmed by Ptolemy, AD 2nd century is an old description of the universe with Earth at the center.
- The model served as the predominant description of the cosmos in many ancient civilizations before Copernicus, AD 16 century.



Key Concepts of Geocentrism

- Each planet is moved by a system of two spheres: **deferent and epicycle**.
- The **deferent** is a bigger circle whose center is Earth and the **epicycle** is a smaller circle which is embedded inside the deferent. This theory is for explaining the retrogression of planet
- Earth, the centers of epicycle of Mercury and Venus and Sun are on the line. This theory is for explaining the maximum digression angle

Ptolemy's Model of the Solar System

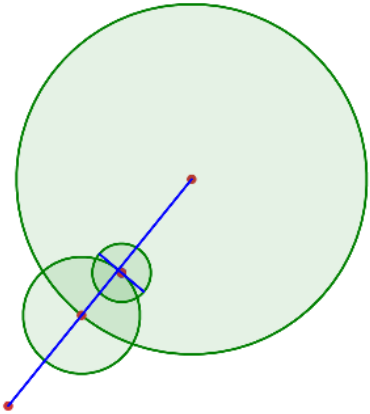


Simulation Part of Geocentrism

Let me show just three slides of dynamic interdisciplinary textbooks developed by me and my graduate students

UNITWIN

1. Simulation of Retrogression of Venus by Geocentrism

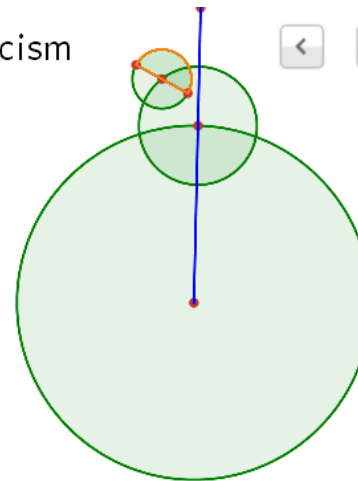
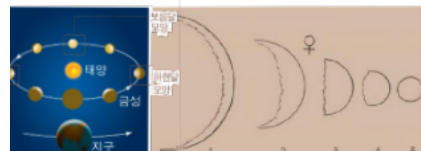


2: The False of Geocentricism

If Geocentrism is right and there is Venus between Sun and Earth, we cannot watch the full moon shape of the Venus.

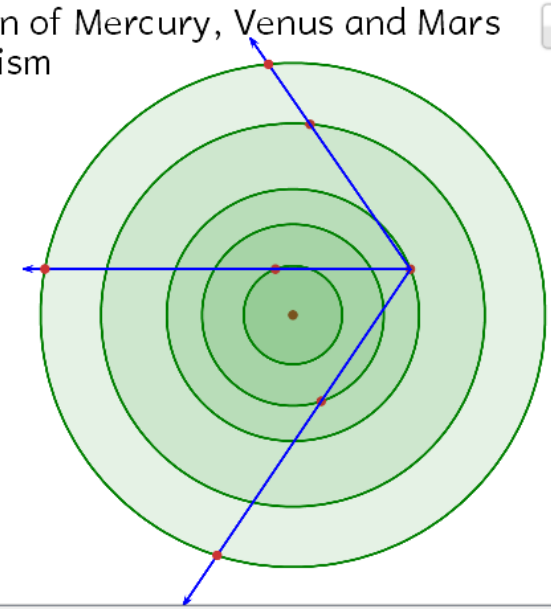
Galileo found various shapes of the venus including the full moon shape.

This means that the Geocentricism is wrong.



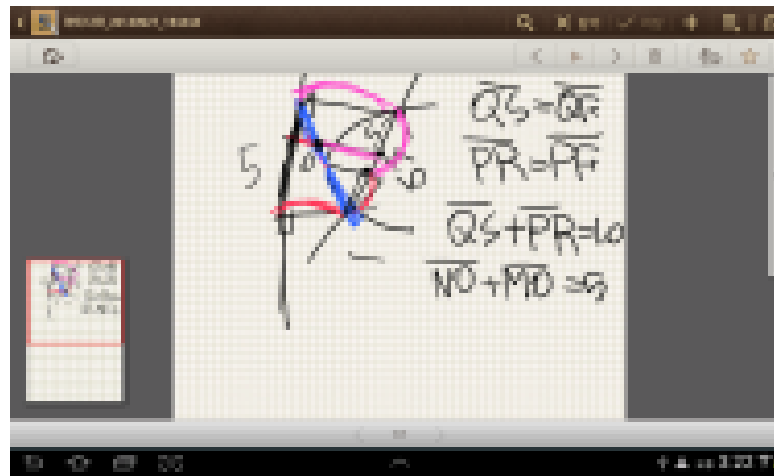
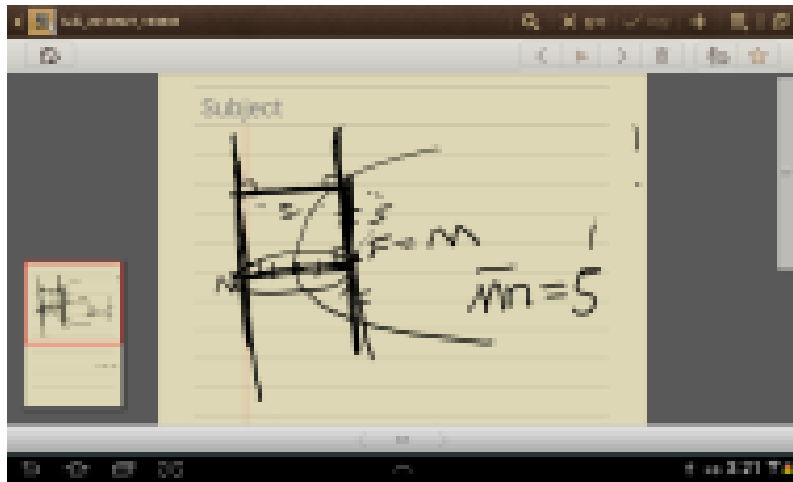
3. Retrogression of Mercury, Venus and Mars by Heliocentrism

Let's simulate the out-appearance revolution of Mercury, Venus, and Mars on the celestial sphere



Teacher Education with dynamic interdisciplinary textbook

- In managing a dynamic textbook through on-line classes, teachers have to guide students' work, encourage students to communicate with peers, and consider informal assessment based on students' activities, which are all unfamiliar experiences for many teachers.
- We have to train teachers with the new environment urgently, which is totally different teacher education we have had no experience before.



Conclusion



In the new world,
it is not the big fish
which eats the
small fish, it's the
fast fish which
eats the slow fish

Klaus Schwab
Founder and Executive Chairman
World Economic Forum

- The education needed during the Fourth Industrial Revolution should foster smart thinking rather than a large amount of knowledge.

dynamic convergence textbooks

- Pandemics from infectious diseases are expected to accelerate the Fourth Industrial Revolution.
- In order to lead the period of social change, the concept of **operation and connection** to cultivate students' "**dreams and talents**" should be emphasized in education as educational innovation is necessary.
- The urgent development of "dynamic interdisciplinary textbooks" and the training of teachers with new textbook in their on-line instruction should be the starting point for educational change.

Final Words: UNITWIN-KNUE

- Finally, I hope UNITWIN-KNUE conference be the door to the future, the mirror to reflect ourselves, and **window towards the future** in designing the new education to lead the revolutionary age.

