

READING CORE TEXTS TO BRIDGE TWO CULTURES:

TEACHING SCIENCE TO HUMANITIES STUDENTS AND
LEARNING HUMAN VALUES THROUGH SCIENCE TEXTS

Leung Mei Yee

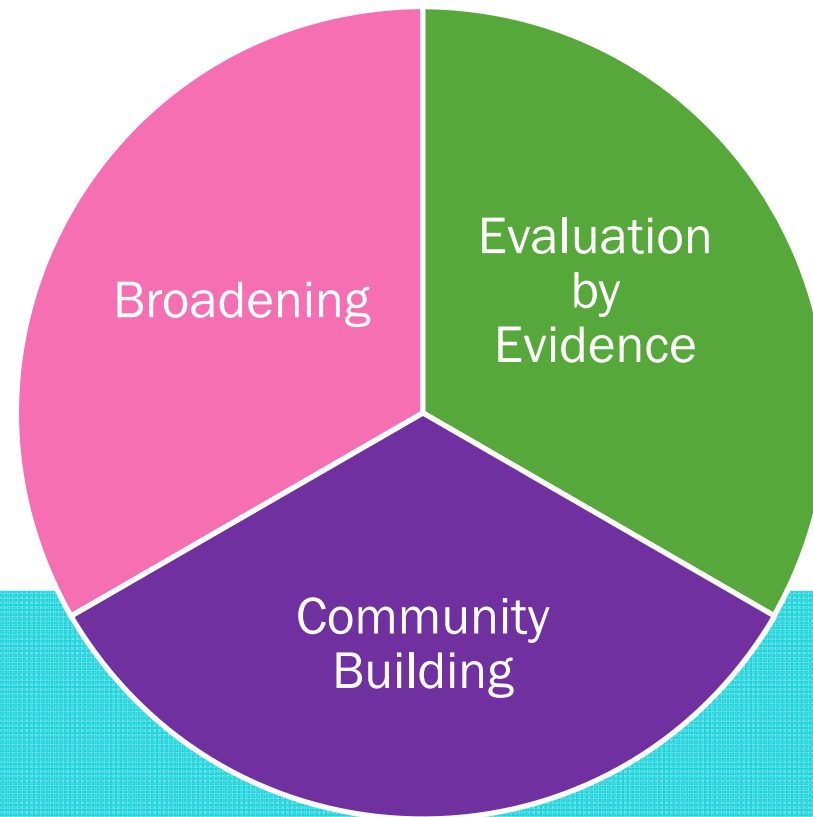
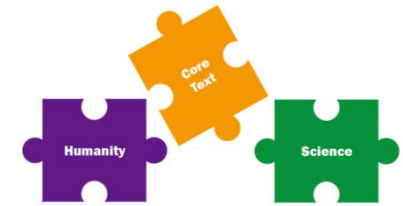
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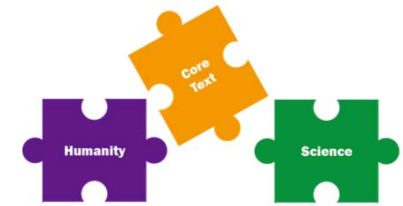
Nov 2016

Seminar on UGC Teaching Awardees' Sharing: The Education University of Hong Kong



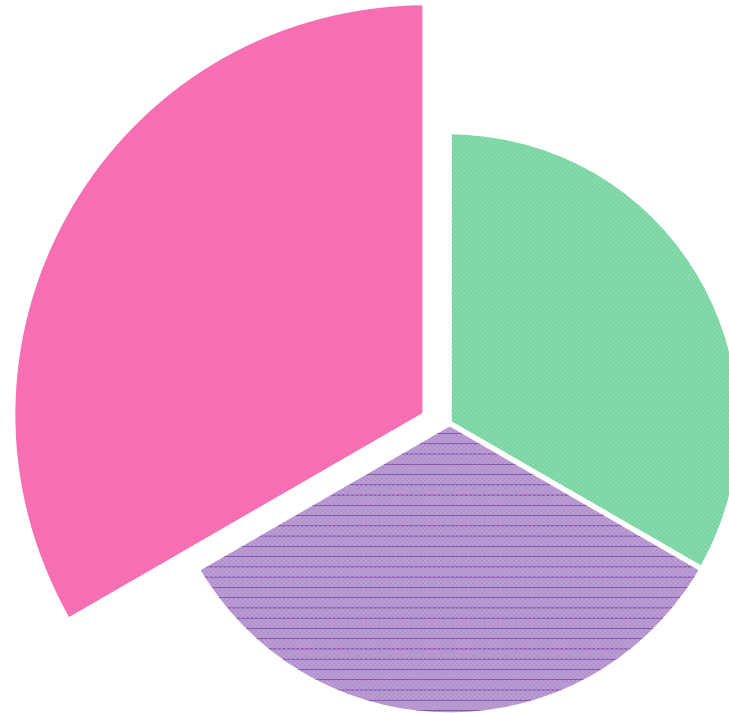
IDEAL GENERAL EDUCATION IS ABOUT...

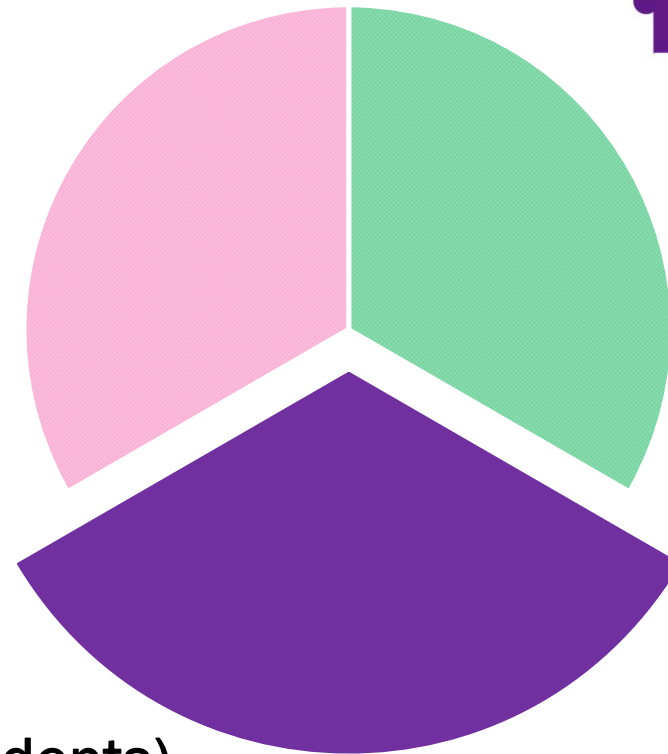
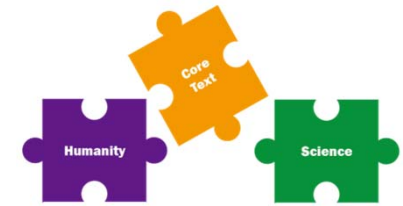




BROADENING

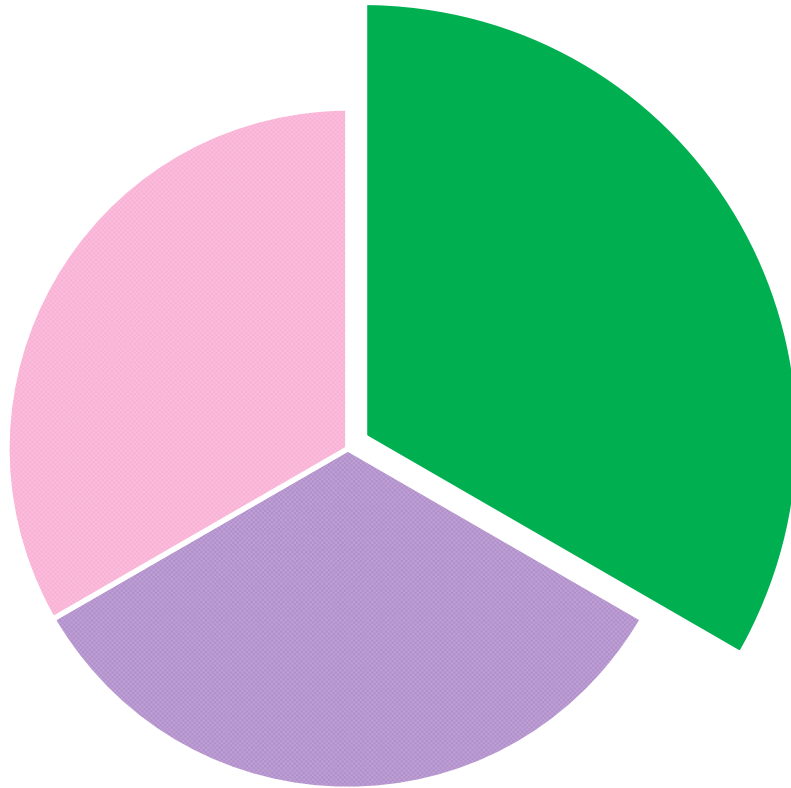
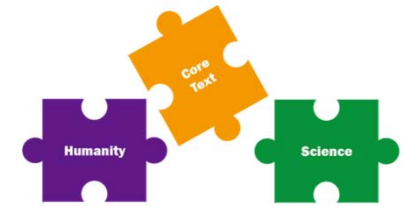
- **Appreciate** cultures and disciplines other than one's own





COMMUNITY BUILDING

- Community of learners (students)
- Community of practice (teachers)

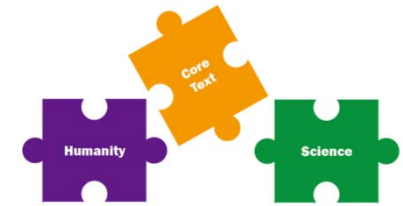


EVALUATION BY EVIDENCE

- Qualitative & quantitative
- Subjective & objective

BROADENING IN CUHK

... DISTRIBUTION MODEL



Effective in Bridging Cultures?

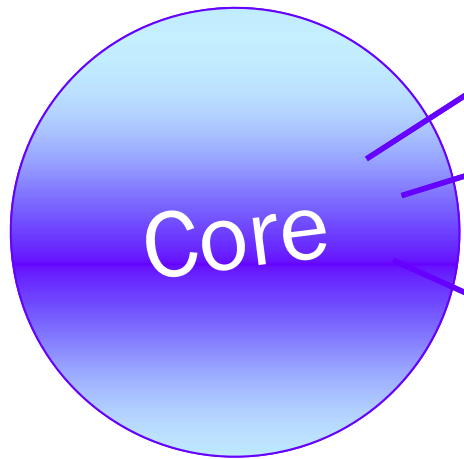
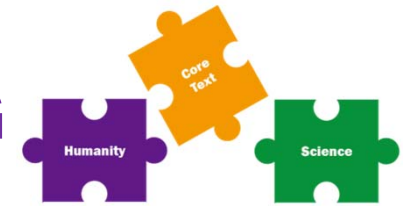
Area A
Chinese Cultural Heritage

Area B
Nature, Science & Technology

Area C
Society & Culture

Area D
Self & Humanity

BROADENING and COMMUNITY BUILDING ... CORE COMPONENT, 2012



- **courses:** required of all (3,800/yr.)
- **texts:** classics on common human concerns
- **questions:**
 - What is a good life & good society?
 - What do we know about nature and what are the limitations of such knowledge?

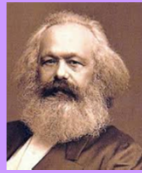
Good life?

Good society?

In Dialogue with Humanity

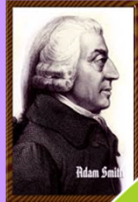
與人文對話

Marx: *Economic and Philosophic Manuscripts of 1844*
(1818-1883)



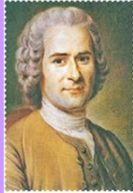
Homer: *The Odyssey*
(~800 BCE)

Adam Smith: *The Wealth of Nations*
(1723-1790)



Plato: *Symposium*
(~423 -347 BCE)

Rousseau: *The Social Contract*
(1712-1778)



Aristotle: *Nicomachean Ethics*
(385 - 322 BCE)

黃宗義: 《明夷待訪錄》
(*Waiting for the Dawn*)
(1610-1695)



孔子: 《論語》 (Confucius: *The Analects*)
(551 - 479 BCE)

**Part III:
Self in Social
Institutions**
建制中的自我

**Part I:
Self and
Human
Capacity**
自我與人的潛能



莊子: 《莊子》 (Zhuangzi)
(370 - 287 BCE)

**Part II:
Faith and Human
Limitation**
信仰與人的限制

The Qur'an



一行禪師: 《般若之心》
(Thich Nhat Hanh: *The Heart of Understanding*)
(1926 -)



《聖經》 (The Bible)

Scientific
knowledge?

Limitations?

In Dialogue with Nature

與自然對話

Euclid: *Elements* (~ 300 BCE)

Dunham: *The Mathematical Universe*
(1947—)

沈括: 《夢溪筆談》
(1031-1095)

Sivin: *Why the Scientific
Revolution Did Not Take Place
in China—or Didn't It?*
(1931—)

Needham: *The Shorter Science
and Civilization in China*
(1900-1995)

Kandel: *In Search of Memory*
(1929—)

Poincaré: *Science and Method*
(1854-1912)



Carson: *Silent Spring*
(1907-1964)



Plato: *Republic*
(~423 -347 BCE)



Lindberg: *The Beginnings of Western
Science*
(Aristotle's philosophy)
(1935-2015)



Newton: *The Principia*
(1642-1727)



Cohen: *The Birth of a New
Physics* (1914-2003)



Darwin: *On the Origin of Species*
(1809-1882)



Watson: *DNA: The Secret of Life*
(1928—)

III. Reflection
on Under-
standing
反思科學探索

I. Physical
Universe
物理世界

II. World of Life
生命世界

COMMUNITY OF LEARNERS



seminar-based tutorial:

- Community of active/autonomous learners
 - 1-hr lecture + 2-hr tutorial
 - Discussion groups ≤ 25
 - Reading the same set of texts
 - Discussion of common concerns
 - Writing to deepen reflection



In Cantonese,
Putonghua & English

CAN STUDENTS COPE WITH THE CHALLENGES?

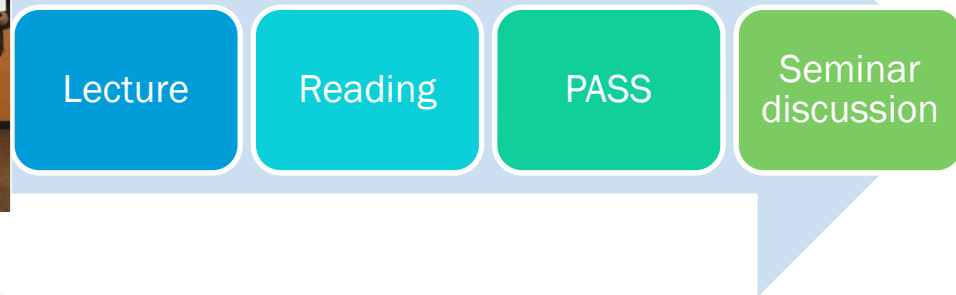


COMMUNITY OF LEARNERS

TARGETED LEARNING SUPPORT



- Peer Assisted Study Session
 - led by senior students



- Academic writing workshops



In Cantonese,
Putonghua & English

COMMUNITY OF LEARNERS

READING DIFFICULT TEXTS



- *DiaNable* – Mobile Learning App

The image displays the DiaNable mobile learning app interface and a screenshot of the CUHK Courseware Development Grant Scheme (CDGS) website. The app interface is split into two parts: 'DIANABLE' (UGFN) and 'DAIMON' (UGFH). The website screenshot shows the CDGS page with a navigation bar for years from 2010-11 to 2015-16 and a description of the scheme.

DIANABLE (UGFN)

In Dialogue with Nature
UGFN1000

- Lindberg
- Cohen-Newton
- Darwin
- Poincaré

DAIMON (UGFH)

In Dialogue with Humanity
UGFH1000

- ερωσ
- 逍遥
- الإسلام
- L'homme est né libre

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Courseware Development Grant Scheme (CDGS)

香港中文大學
The Chinese University of Hong Kong

2010-11 2011-12 2012-13 2013-14 2014-15 2015-16

Theme (CDGS)

has set up a Courseware Development Grant Scheme (CDGS) to invite applications from members of the teaching and learning community. The University's Education Technology Committee on Education Technologies of the University's IT Governance Committee has applied funding from the CDGS. The aim of CDGS is to encourage teachers to move forward from the basic use of eLearning environments for their students.

2009-10, 2010-11, 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 are provided in the respective pages.

Dianable: CDG 2013-14

Daimon: CDG 2014-15

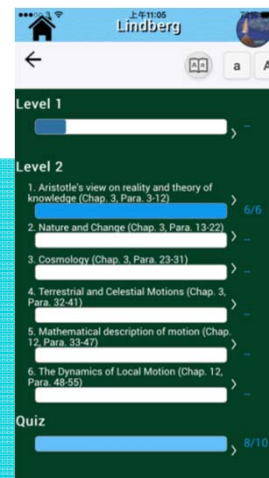
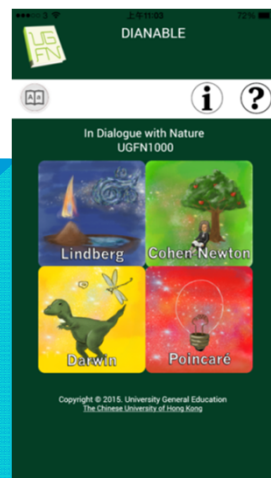
[For both Android and iOS platforms]

COMMUNITY OF LEARNERS

READING SCIENCE TEXTS



- ***DiaNable*** – Mobile Learning App
 - 4 out of 11 texts in “In Dialogue with Nature” are included in *DiaNable*
 - Text 2: *The Beginnings of Western Science* – Lindberg
 - Text 3a: *The Birth of a New Physics* – Cohen
 - Text 3b: *The Principia* – Newton
 - Text 4: *On the Origin of Species* – Darwin
 - Text 7: *Science and Method* – Poincaré
 - All questions are MC or T/F questions



Reading Companion

Self-Evaluation

COMMUNITY OF LEARNERS

READING SCIENCE TEXTS



- *DiaNable* – Mobile Learning App
 - Reading Companion

下午12:01
Lindberg : Level 1

1. Which of the following is Aristotle's view on 'form' and reality?

- Traits have a prior existence in the world of forms
- Forms are perfect ideas of everything in the material world.
- Corporeal objects exist independently; form is just the property of objects.
- Neither the world of forms nor the material world exists.

You've got it!
Aristotle's View on Reality and Theory of Knowledge (Chap. 3, Para. 3-12)

2. Which of the following concepts CANNOT explain why a green leaf turns yellow?

- From four Aristotelian causes
- The change is caused by the nature of that leaf

Reset

下午12:02
Lindberg : Level 2

Cosmology (Chap. 3, Para. 23-31)

1. How did Aristotle describe the origin of the universe?

- The universe was created by the God.
- The universe is eternal without a beginning.
- The universe formed after a big explosion.
- The universe was formed by chance.

Wrong! See answer highlighted.
Read Chap. 3, Para. 23-24

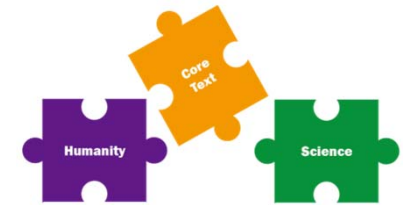
2. Which of the following statements are correct?

- (1) The **terrestrial region** is filled with **aether**.
- (2) In the **supralunar region**, all motions are eternal and circular.
- (3) In the **sublunar region**, air can be transformed into fire when the wet of air becomes dry.
- (4) There is no **transient change** in the **celestial region**.

Reset

COMMUNITY OF LEARNERS

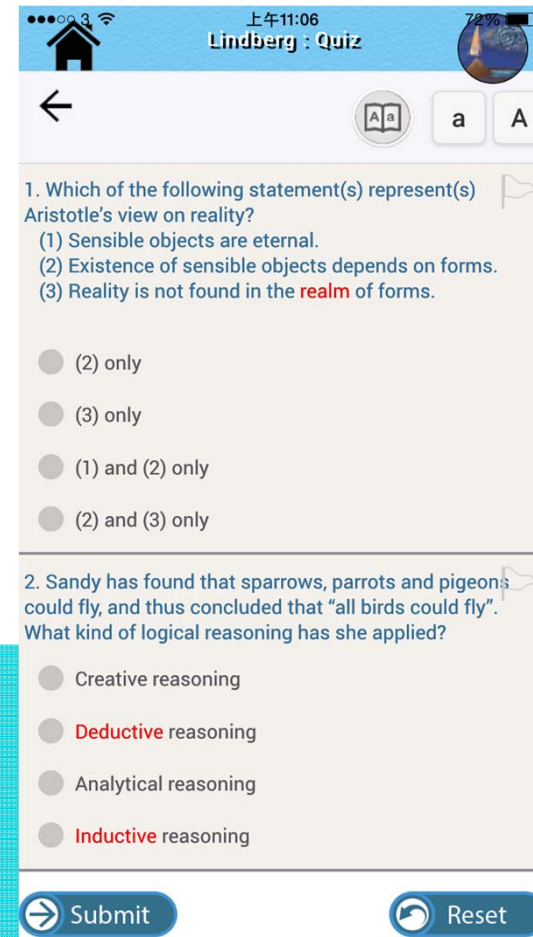
READING SCIENCE TEXTS



- **DiaNable – Mobile Learning App**

- **Quiz**

- 10 randomly chosen questions
- Answers are shown when you press 'Submit'
- Our server will collect your answers anonymously – will NOT affect your scores in this course at all



COMMUNITY OF LEARNERS

READING SCIENCE TEXTS



- **DiaNable – Mobile Learning App**

- **Dictionary**

- Arranged:
 - By paragraph (Chapter. Paragraph. Line)
 - By alphabetical order
- Searchable
- Pronunciation of names/ terms in original language



COMMUNITY OF LEARNERS

UNDERSTANDING SCIENTIFIC CONCEPTS



- **Micro-modules – e-learning**
 - Supplementary courseware for providing science knowledge deemed necessary to non-science students to study “In Dialogue with Nature” since 2014

Micro-Module Courseware Development

MMCD2015 - Supplementary courseware for non-science students studying UGFN1000

Introduction to the Supplementary set for UGFN

Welcome to the supplementary courseware for UGFN1000. This courseware is designed to provide additional help to students without highschool science background when studying UGFN1000. In Dialogue with Nature. Currently, the courseware compose of 3 sets of materials namely, Physics, Biology and Chemistry. Each set includes a series of recorded video and a set of interactive exercise. Use as many sets as you like at your own will and at your own pace!

For more info about the purpose and history of this supplementary set, have a look at this video.

Physics

This supplementary set is best used just before or after attending the lecture for text 2 on medieval physics. It will covers some concepts mentioned in Text 2 and 3.

- The lecture ppt
- Online exercise
- The recorded lecture video:
 - Part 1) Definitions in Physics, slides 1-14
 - Part 2) Newton's 3 Laws, slides 15-31

Biology

This supplementary set is best used just before or after attending the lecture for text 4 on evolution. It will covers some concepts mentioned in Text 4 and 5.

- The lecture ppt
- Online exercise
- The recorded lecture video:
 - Part 1) Ecology and Biology, slides 1-13
 - Part 2) Cellular Biology, slides 14-23
 - Part 3) Evolution, slides 24-34

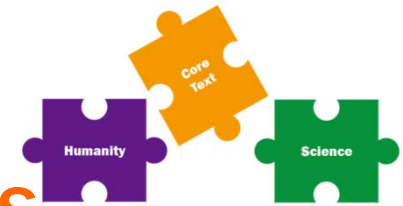
Chemistry

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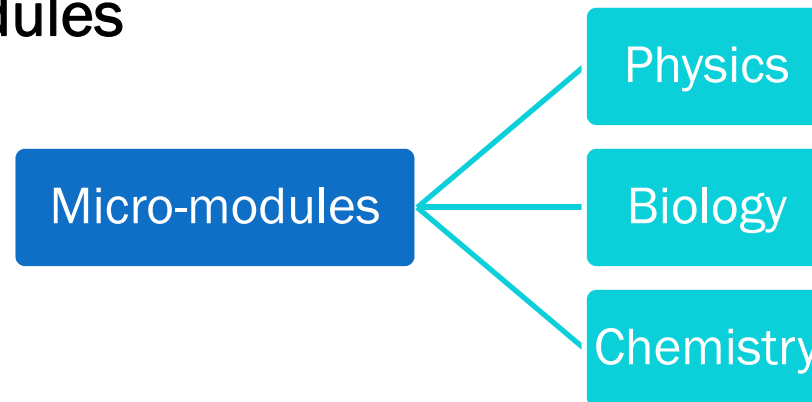
http://www.cuhk.edu.hk/eLearning/c_tnl/mmcd/showcase/2015_23.html

COMMUNITY OF LEARNERS

UNDERSTANDING SCIENTIFIC CONCEPTS



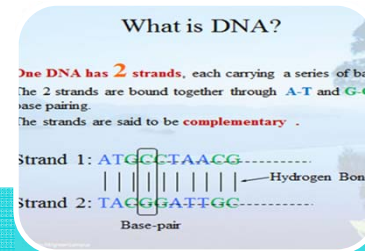
- Micro-modules



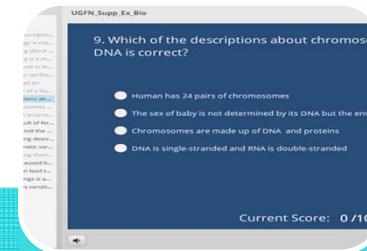
- Each set of materials contains:



Recorded lecture



Lecture ppt



Interactive quiz

COMMUNITY OF LEARNERS

UNDERSTANDING SCIENTIFIC CONCEPTS



- **Micro-modules**

Physics:

- Definitions in Physics, (Mass, Momentum, etc)
- Newton's 3 Laws

Biology:

- Definitions in Ecology and Biology (Food Web, Species, etc)
- Cellular Biology (Chromosomes, DNA, etc)
- Modern Evolutionary Theory

Chemistry:

- Atomic theory and Periodic table
- Changes and Reactions
- Organic Chemistry

EVALUATION BY EVIDENCE

Entry-exit survey

- Developed by Kai-ming Kiang, Andy Ng and Derek Cheung

Students' Reflections in Focus Group Interviews

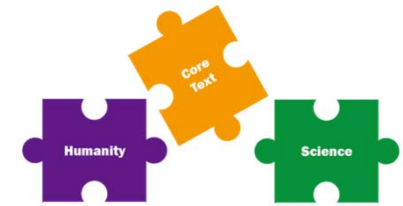
- Collected by Kai-ming Kiang, Andy Ng, Derek Cheung and Shelly Liao

ENTRY-EXIT SURVEY

DEVELOPED BY KAI-MING KIANG, ANDY NG & DEREK CHEUNG

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY



- **Data**
 - Follow Astin’s talent development approach
 - In 2014-15 Term 2:

Number	“In Dialogue with Nature”	“In Dialogue with Humanity”
Participating Teachers	8	5
Tutorial Classes	42	25
Tracked Students (Tracked Rate)	389 (44.2%)	205 (38.2%)

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY



- Data collected at the time of **first** and **last** tutorial session
- Measures students' perception towards learning outcome attainment (in 6-point Likert scale)
- Students are tagged to trace the changes of perception

1. I can analyze and evaluate arguments critically. 我能以批判的眼光去分析及評價不同的論點
2. I am open to new and different ideas. 我可以接受新的、不同的想法
3. I can articulate clearly my ideas in writing. 我能清晰地以文字說明自己的想法
4. I can express clearly my ideas orally. 我能清晰地以口頭表達說明自己的想法
5. I am confident in reading difficult texts in English. 我有信心以英語閱讀艱深的文章

	Strongly Disagree 非常不同意		← →		Strongly Agree 非常同意		N/A 不適用
	1	2	3	4	5	6	N/A
1.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY



- In Dialogue with Nature (all students)

Sample size = 389

In Dialogue with Nature (on generic skills)	Entry	Exit	Diff.
1. I can analyze and evaluate arguments critically.	4.15	4.80	+0.65*
2. I am open to new and different ideas.	4.71	5.12	+0.41*
3. I can articulate clearly my ideas in writing.	4.12	4.52	+0.40*
4. I can express clearly my ideas orally.	4.08	4.51	+0.43*
5. I am confident in reading difficult texts in English.	3.63	4.15	+0.52*
In Dialogue with Nature (on UGFN course-specific outcomes)			
6. I am confident in reading science-related texts.	4.08	4.47	+0.39*
7. I am interested in natural science.	4.35	4.74	+0.39*
8. Scientific knowledge is important for my intellectual development.	4.59	4.96	+0.37*
9. I understand the development of natural science.	3.48	4.62	+1.13*
10. I understand various features of scientific methods.	3.74	4.74	+1.00*
11. I understand the contributions and limitations of scientific inquiry.	3.89	4.80	+0.91*
12. I can assess the social implications of scientific inquiry.	3.87	4.70	+0.83*

Note:

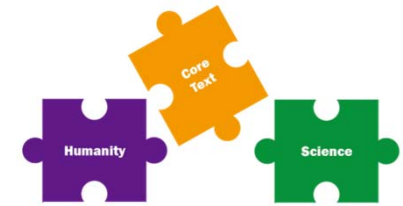
Diff.: Exit survey – Entry survey

* denotes statistical significant improvement (two-tailed paired t-test at $p \leq .05$)

Data from 2014-15 Term 2

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY

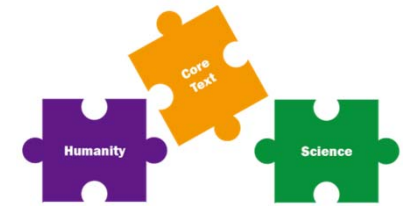


- **In Dialogue with Nature**
 - Divided along the line of science-related background
 - Comparison between student with high school science background and students without high school science background
 - High school science related subjects are:
 - Physics, Chemistry, Biology, Integrated Science, Combined Science

Data from 2014-15 Term 2

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY



- In Dialogue with Nature
(on generic skills)

	<i>Without Science Background</i> (N=83)			<i>With Science Background</i> (N=309)		
	Entry	Exit	Diff.	Entry	Exit	Diff.
1. I can analyze and evaluate arguments critically.	4.17	4.72	+0.55*	4.14	4.82	+0.66*
2. I am open to new and different ideas.	4.59	4.94	+0.35*	4.74	5.17	+0.43*
3. I can articulate clearly my ideas in writing.	4.22	4.52	+0.30*	4.10	4.52	+0.42*
4. I can express clearly my ideas orally.	4.12	4.49	+0.37*	4.07	4.51	+0.44*
5. I am confident in reading difficult texts in English.	3.40	3.94	+0.54*	3.69	4.21	+0.52*

Note: Diff.: Exit survey – Entry survey

* denotes statistical significant improvement (two-tailed paired t-test at $p \leq .05$)

Data from 2014-15 Term 2

EVALUATION BY EVIDENCE

ENTRY-EXIT SURVEY



- In Dialogue with Nature
(on UGFN course-specific outcomes)

	<i>Without Science Background</i> (N=83)			<i>With Science Background</i> (N=309)		
	Entry	Exit	Diff.	Entry	Exit	Diff.
6. I am confident in reading science-related texts.	3.35	4.00	+0.65*	4.28	4.60	+0.32*
7. I am interested in natural science.	3.48	4.11	+0.63*	4.58	4.91	+0.33*
8. Scientific knowledge is important for my intellectual development.	3.99	4.61	+0.62*	4.75	5.06	+0.31*
9. I understand the development of natural science.	2.96	4.39	+1.43*	3.63	4.68	+1.05*
10. I understand various features of scientific methods.	3.02	4.45	+1.43*	3.94	4.82	+0.88*
11. I understand the contributions and limitations of scientific inquiry.	3.40	4.66	+1.26*	4.03	4.84	+0.81*
12. I can assess the social implications of scientific inquiry.	3.63	4.63	+1.00*	3.93	4.72	+0.79*

Note: Diff.: Exit survey – Entry survey

* denotes statistical significant improvement (two-tailed paired t-test at $p \leq .05$)

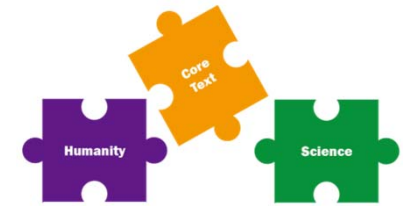
Data from 2014-15 Term 2

STUDENTS' REFLECTION IN FOCUS GROUP INTERVIEWS

COLLECTED BY KAI-MING KIANG, ANDY NG, DEREK CHEUNG &
HELLY LIAO

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS



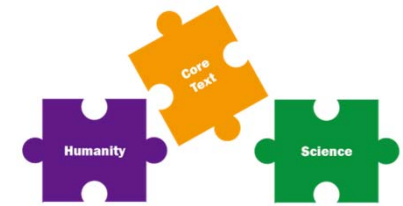
- Change of Attitude

My feeling is that he [the teacher] talked about some new concepts. As I only studied the humanities and had no ideas about science subjects at all, I was extremely **scared** at the beginning, because ... there were texts about physics in Part I. I never thought of what the three Newton's laws were about. But when he really taught [these laws], I found they were **not as difficult to understand as I had imagined**...Then you would think more: you started wondering in daily life which phenomena were related to Newton's Law...

(G3-11, Communication)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS

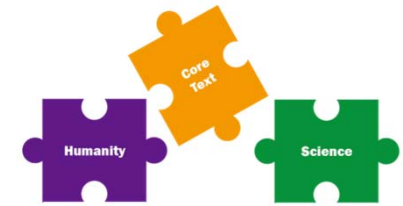


- Change of Attitude

[the course] has changed my view on science. Because I was so lame in studying science subjects, I found them very **annoying**...and thought them **useless**...and in your daily life, even you know nothing about the principles behind which make the world moves, it seems alright. But when you have learnt [about these principles], you would **appreciate** more the efforts [those scientists] made...(G8-4-Communication)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS

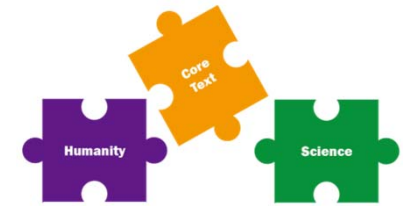


- Truth in Science

Very often we will believe our intuition and make judgement...but the discussion on the illusion of the five senses made me think a lot...when I say the others are wrong, or the other say I am wrong, it is not that how many people think it right or wrong makes it right or wrong. It is what **theory** or **reason** that you have to **support** your statement makes it a correct statement. It is not determined by the majority. (G10-2, IBBA)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS

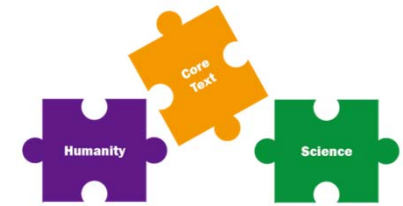


- Truth in Science

When writing my Reflective Journal, I put down at that time that I believed in science because it was backed up by a very vigorous theoretical system... and the scientists were seriously verifying, overthrowing the incorrect ones...but then, after handing in my RJ, in the next chapter, my arguments were **challenged** (G9-11, Communication)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS



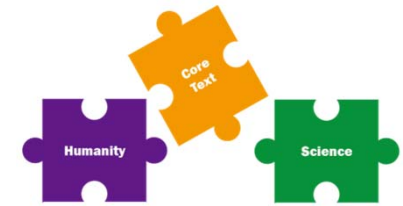
- Truth in Science

After taking *In Dialogue with Nature*, my feeling is that science [knowledge] is **not the absolute truth**, but it is **seeking for the truth**...For example, when you read , or even before you read texts about Aristotle and Plato, you knew [their “science”] was wrong. But after reading them you would appreciate their attitude to seek for the truth, with **reason**, and right, with **determination**...
(F32-7, Statistics)

EVALUATION BY EVIDENCE

STUDENTS' REFLECTION

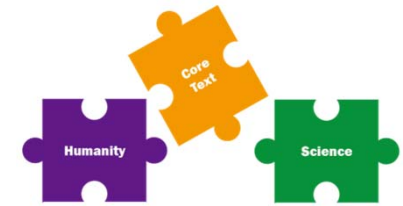
IN FOCUS GROUP INTERVIEWS



- Truth in Science

Science...is **not always truth**...Newton's Laws are proven wrong by the Einstein's theories of relativity, but Einstein's theories are challenged by quantum mechanics...so [scientists] were always seeking for the truth but proven wrong... However, by seeking, they got nearer and nearer the truth...right.(F33-1, Statistics)

EVALUATION BY EVIDENCE



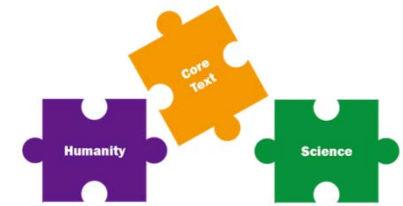
FOCUS GROUP INTERVIEWS

- Reflection on Values

The course makes me think: Should we **take** the **development** of science and technology **for granted**?...Now when a brand new technology is invented, I would think about what the impact it would have on the environment...Are human beings not destroying the existing equilibrium in nature? (F31-11, 32-5 Computer Science)

EVALUATION BY EVIDENCE

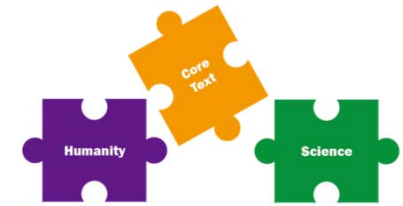
FOCUS GROUP INTERVIEWS



- Reflection on Values

Darwin's Origin of Species is very inspiring. According to him, we are all **transients**. We are born...In the measure of the Earth, the birth of human history is so very short, so **GPA is just like clouds in the sky**...When you are aware of the smallness of yourself, something you thought of great significance becomes less important...(G15-2 & 4, Chinese Education)

EVALUATION BY EVIDENCE



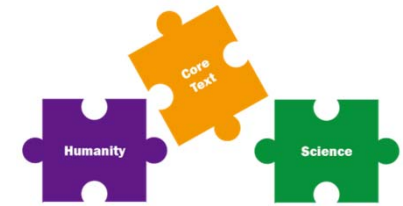
FOCUS GROUP INTERVIEWS

- Reflection on Values

I like animals very much...yet when you read Darwin's theory on evolution of species, you may think that in the course of nature some animals are **destined to extinction**, but new species may come out...So you start to think that some happenings **cannot be changed**. Law of nature is like that. I start questioning somebody who tries to protect what ever the cost some animals from extinction, is it necessary? (G14-4 Communication)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS

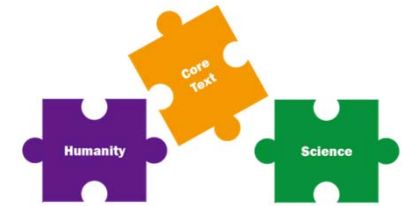


- Reflection on Values

I agree that human being is only transient in a segment of the tree of lives, but I don't think we don't need to protect the animals from extinction, because I think...when we live, we **make choice** to construct or to destroy the environment for other animals...we can do much...and this is our **responsibility**...(G15-8, IBBA)

EVALUATION BY EVIDENCE

FOCUS GROUP INTERVIEWS

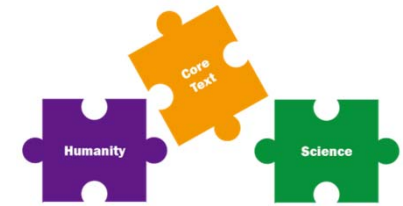


- Reflection on Values

Darwin talked about survival for the fittest. But in fact, [it is because] we have done so much to ...reshape the living environment of other species that they can not change or adapt, and finally extinct. I think this is **our problem**, and it implicates other remote problems such as policy on population, or distribution of resources. These problems make me think a lot.... In fact they are **not** that **remote**, they are so close, and we are involved. (G16-2 IBBA)

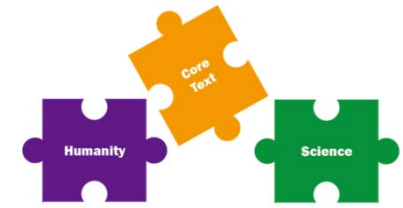
EVALUATION BY EVIDENCE

READING SCIENCE CLASSICS IN GE



- General/ Liberal Education is that it equips
 - the mind to enjoy a broad range of experiences that would **otherwise remain inaccessible**. (Hirst, 1973, Cited by R.N. Carson)*
 - people to **think for themselves** instead of to give predictable response
- Reading classic texts in science is an effective form of general/ liberal education because science is learnt
 - **not** for its **instrumental** values, but
 - for its **ways of thinking** and knowing, and
 - in its moment of **discovery**
 - in its **impact** on and **connection** with human life

* R.N. CSARSON, "SCIENCE AND THE IDEAL OF LIBERAL EDUCATION",
SCIENCE AND EDUCATION 6:225-238, 1997.



Thanks!