

A study on Teaching the Evolution in Biological Sciences Education: the Case Study of BSCS in the USA

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A Study on Teaching the Evolution in Biological Sciences Education : the case study of BSCS in the USA

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I. The purpose of study

- Reconsidering the reasons of learning the Evolutionary Theory in Biological Sciences Education for Secondary School in Japan, based on the reasons why Biological Sciences Curriculum Study (BSCS) emphasizes teaching of this Theory.

The definition of evolutionary theory

Evolution

The change in organisms during the long history of life on earth.

Evolutionary Theory

The theory about factors that organisms evolve.

2. The Background of study

- the Introduction and Treatment of the Evolutionary Theory in JAPAN

Timing of the introduction of the Evolutionary Theory

Murakami (1964) reasoned that the timing was around 1874, using the facts which the words “Darwin” were written within “北郷談”.

Acceptance of the Evolutionary Theory in Japan

Murakami (1964) concluded that society of Japan has accepted the Evolutionary Theory not as scientific theory, but as fundamental principles of statements and policies concerned with society.

Importance of the Evolutionary Theory in Biological Sciences Education

Mahune et al. (1981) and Tukuba (1967) described the importance of learning the Evolutionary Theory that students can recognize systematically organisms through the viewpoint of the Evolutionary Theory.

2. The Background of study

- the ideas of the Evolutionary Theory on present the Course of Study in Japan

Course of Study(学習指導要領)

- This is the guidance that represents contents and objectives for each subject for each school (Elementary School, Lower Secondary School, Upper Secondary School).
- Teachers must follow this when they design curriculum, and teach.
- Likewise, Contents of textbooks must follow this.
- The Course of Study for Lower Secondary and Upper Secondary were revised, and will be implemented fully in 2012(Lower Secondary) and in 2014(Upper Secondary).

2. The Background of study

- the ideas of the Evolutionary Theory on present the Course of Study in Japan

Lower Secondary	Subject
	Japanese(国語)
	Social Studies(社会)
	Mathematics (数学)
	Science (理科)
	English(英語)
	⋮
	⋮

Concepts

Energy and Particles

Life and Earth

- Grade **8** student
- Change and Evolution of Organisms

Major contents

- Commonality of vertebrate, Commonality between Modern species and Fossils.
- Students are asked to recognize that Modern species have been changing from past species, relating to body structures of animals.

2. The Background of study

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Course of Study for Upper Secondary

Subject: Science (理科)

Course	Credit
Science and Human Life (科学と人間生活)	2
Basic Physics (物理基礎)	2
Physics (物理)	4
Basic Chemistry (化学基礎)	2
Chemistry (化学)	4
Basic Biology (生物基礎)	2
Biology (生物)	4
Basic Earth Science (地学基礎)	2
Earth Science (地学)	4
Research Program (理科課題研究)	1

Mandatory Number of Credits
are **6** credits.

Type A

SHL(2) + Basic(2) × 2

Type B

Basic(2) × 3

To take 'Biology'

Students who take Biology
must take Basic Biology
in advance.

Evolution and
Phyletic Line of Organisms

2. The Background of study

- the ideas of the Evolutionary Theory on present the Course of Study in Japan

A Treatment of the Evolutionary Theory in “Evolution and Phyletic Line of Organisms”

Major contents

- Origin of Life and Change of Organisms: Represents the specific examples of relationship between Change of Organisms and Environmental Change.
- Mechanism of Evolution: Mutation, Natural Selection, Genetic Drift, Adaptation, Molecular Evolution

My comments for a treatment of the Evolutionary Theory in Japan

1. Lower Secondary Students learn only the fact that the Evolution has occurred in past time.
2. At Upper Secondary, some students who take Biology learn the mechanism of the Evolution.

2. The Background of study

- the ideas of the Evolutionary Theory on present the Course of Study in Japan

Mahune et al. (1981)

The traditional way of teaching the Evolutionary Theory is firstly representing the evidences that have students recognize the Biological Evolution, secondary making students convince that present organisms have evolved from past one, finally explaining the Evolutionary Theory simply. However, as discussed, only representing the evidences is not effective teaching.

It may be not able to say that students could understand the explanation capability of the Evolutionary Theory and acquire the unifying viewpoint of nature and organisms.

2. The Background of study

- the ideas of the Evolutionary Theory on present the Course of Study in Japan

Numata (1960)

In Japan, the Evolutionary Theory has not become a serious problem and has not been discussed deeply. Although there are many reasons, main reason was social and historical context that the Evolutionary Theory have been embraced easily without leading to some fierce arguments.



Once again, it need be reconsidered the reasons that students should learn the Evolutionary Theory from not Social Evolutionism but the educational viewpoint.

2. The Background of study - about BSCS

Biological Sciences Curriculum Study (BSCS)

- BSCS was established by founding from National Science Foundation in 1958.
- Address: Colorado state, the U.S.
- High school Biology, middle school science and elementary school science program.
- BSCS's programs are emphasizing the Evolutionary Theory as the unifying principle of program.

The Previous Study of BSCS in Japan

Umeno (1996) pointed out that

- The reasons and background about establishment of BSCS.
- The BSCS's work in early phase of establishment.
- The influence to Biological Sciences Education of Japan.

Tanzawa (1994) reviewed that changing of BSCS's program from a view of STS curriculum based on concepts of scientific literacy.

2.The Background of study - about BSCS

Unoura (2004) divided a history of creationism in the U. S. into three periods, based on Edward(2003). Form 1925 to 1968: The period of prohibition against teaching the Evolutionary Theory

Thomas F. Gieryn et al. (1985)

“Publisher’s reluctance to include

potentially inflammatory descriptions of evolution

continued in many texts through the 1950s.”

My Prediction

Around BSCS establishment(1958),
teaching the Evolutionary Theory in Schools was resisted
by American society.

2. The Background of study - about BSCS

Gerald Skoog (1971)

- Counted words which concerned with the Evolution in high school biology textbooks.
- Classified a number of those words into the extent 44 topics concerned with the study of the Evolution were emphasized.

Summary of results of Skoog's study

In 1963, BSCS published three high school biology textbooks.

Topics	1900-1919	1920's	1930's	1940's	1950's	1960's	1970's
Total of the Number of Words	18,498	49,325	82,030	111,372	96,822	368,093	186,906
Number of Textbooks	8	14	15	15	14	17	10
Average Words	2,312	3,523	5,469	7,425	6,916	21,653	18,690

Increasing

2. The Background of study - about BSCS

Summary of results of Skoog's study

The word evolution was in the	1900-1919	1920's	1930's	1940's	1950's	1960's	1970's
Text	5/8 63%	7/14 50%	8/15 53%	7/15 47%	6/14 43%	16/17 94%	10/10 100%

Increasing

Summary of results of Skoog's study

"If, as most educations claim, textbooks are important in dictating what, how, and when certain subject matter will be taught, the date in this study are substantial evidence that the study of evolution was a peripheral and neglected part of the biology curriculum prior to the development of the BSCS textbooks in the 1960's."

2. The Background of study - about BSCS

Thomas F. Gieryn et al. (1985)

“In the 1960’s, revamped biology texts prepared by the government-funded Biological Sciences Curriculum Study (BSCS) made evolution a theoretical centerpiece of modern biology.”

Eugenie C. Scott (2001)

“Beginning in 1959, the Biological Sciences Curriculum Study, a group of university scientists and master teachers, prepared a series of high-school biology textbooks that placed evolution squarely at the center of biology education. Because these books had the imprimatur of the government (they were sponsored by the National Science Foundation), they sold well, and encouraged commercial publishers to rewrite their textbooks to include evolution.”

2.The Background of study - about BSCS


Passivity treatment of the Evolutionary Theory



Placed the Evolutionary Theory as an important place
in Biological Sciences textbook

RODGER W. Bybee (2001)

“It is in no sense an overstatement to say that the Biological Sciences Curriculum Study assumed responsibility for putting evolution back into high school biology.”



As a case study, I focused teaching the Evolutionary Theory of BSCS to take some sort of reference to the reasons of learning the Evolutionary Theory.

3.The scheme of study

1

Research on
current BSCS's High school Biology Programs
about the Evolutionary Theory and the Evolution.

2

Research on
the reasons why BSCS has decided to place the
Evolutionary Theory and the Evolution
at the center of those programs.

3

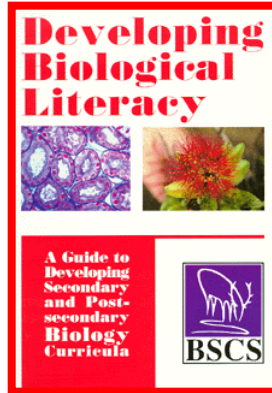
As a result of analyzing ideas and methods of BSCS,
I will reconsider the reasons why we teach and
students learn the Evolutionary Theory
and the Evolution in Schools in Japan.

3. The scheme of study

Research on current BSCS's High school Biology Program about the Evolutionary Theory and the Evolution.

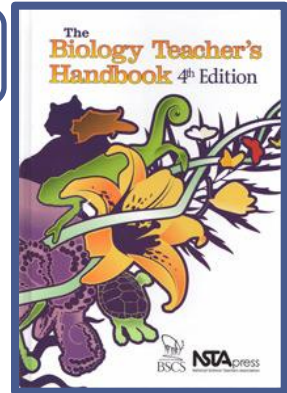
"Developing Biological Literacy"

Guidance to design biology curricula



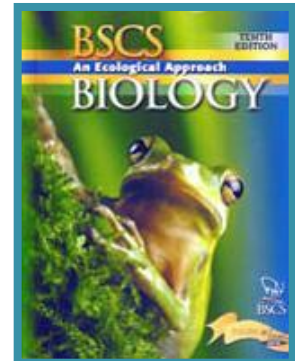
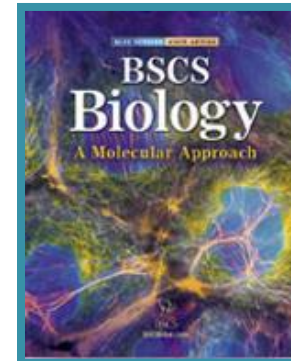
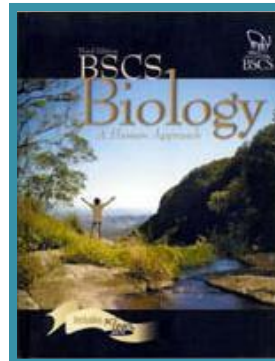
"The Biology Teacher's Handbook "

- Teaching strategies
- Inquiry-based instruction
- Course planning etc



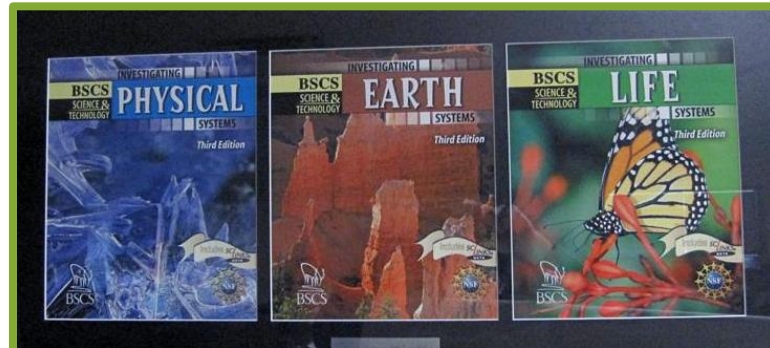
High School Biology Program

Emphasize Human, Molecular, Ecological perspective



Middle School Science Program

Physical, Earth, Life science



3. The scheme of study

2

Research on the reasons why BSCS has decided to place the Evolutionary Theory and the Evolution at the center of those program.

“Developing Biological Literacy”

Six unifying principles

1. Evolution- Patterns and Products of Change

2. Interaction and Independent

3. Genetic Continuity and Reproduction

4. Growth, Development, and Differentiation

5. Energy, Matter, and Organization

6. Maintenance of a Dynamic Equilibrium

• Those unifying principles have been changed several times, but Evolution has been placed the top of those unifying principles.

• The first version of unifying principle was conceptualized by BSCS Steering Committee in 1963.

By analyzing the meeting minutes of BSCS and Newsletters in 1960's, the reasons why BSCS Steering Committee had decided to select the Evolution as unifying principles will be found.

3. The scheme of study

3

As a result of analyzing ideas and methods of BSCS, I will reconsider the reasons why we teach and students learn the Evolutionary Theory and the Evolution in Schools in Japan.

The case study of BSCS

- The reasons emphasizing the Evolutionary Theory and the Evolution in Biological Sciences Education.
- The teaching strategies about the Evolutionary Theory and the Evolution .



Based on the above results ,
I would like to study the reasons we teach and students learn the Evolutionary Theory in Japan.

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Thank you all for listening!