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Biology Teachers' Perception of Value of Biology Learning

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생물교사들의 생물학습의 가치에 대한 인식

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<ABSTRACT>

This study aimed to identify three hypotheses. (1) Korean biology teachers believe that zoology, botany, and genetics are more related to human life than other biological subjects. (2) Korean biology teachers believe that zoology, botany, and genetics are more important than other biological subjects. (3) Korean biology teachers make more effort to teach zoology, botany, and genetics than other biological subjects. Fifty in-service secondary biology teachers participated in this study. All participants were students of Med. program in Korea. This study employed survey methodology. The survey questionnaire involves three sections, which are: (1) demographic data, (2) 7-point Thurstone scale, and (3) open-response questions. In the scale section, participants evaluate biological concepts--zoology, botany, genetics, evolution, and ecology-- based on relevance, value, teaching, and learning. To identify the hypotheses, I used ANOVA to compare the score of each biological concept. For the open-responses, the main terms that teachers used for the responses were extracted and compared. Based on the results, I discussed education implications.

Key words : Biology learning, social value, teaching value, teacher's perception

I. Introduction

It is a very important mission for curriculum developers and school administers to decide what should be taught in schools. As the amount of knowledge that humans have generated is enormous, curriculum developers should thoroughly investigate and design the curricula. There are many factors that curriculum developers should consider for the development of a curriculum. The most important factor they should consider is the cognitive competence of learners. Curriculum developers first should investigate whether or not the learners can achieve the learning goal that curriculum address in terms of Piaget's perspective (Karplus, 1964).

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Moreover, they should consider if the learning concepts are valuable to learn for everyday understanding and knowledge. However, not all factors are related to students and their learning. There are various factors related to the social perspective for the development of curriculum. For example, when the Korean government decided to abolish the evaluation of music, art, and physical subjects in school, many people were strongly opposed to the policy. These people, such as the pre-service teachers, in-service teachers, and university administers, claimed that if the evaluations of those subjects were abolished in school, many schools would have to cut down the number of art and music teachers; eventually threatening the job market. Consequently, universities would also have to cut down the programs that cultivate those teachers. As we can see in this case, the employment of teachers-- which does not seem to be related to curriculum-- should in fact be related to development of curriculum. Curricula and evaluation are related not only to learners but also to various people in the society.

Another instance that we can see the social influence of curriculum development is mathematics and science curricula for the technological and vocational lycee students. Twenty years ago, the Korean government decided to cut down the time for teaching mathematics and science in technological and vocational lycee school. The basis of this policy was that the students in technological and vocational lycee school were those who did not have any motivation to learn science and mathematics, so teaching these subjects was a 'waste of time'. Instead of science and math, the students should learn more technological and vocational subjects such as computer science, musical instruments, or cosmetic treatments. However, many social groups were against this idea because the new policy could snatch the opportunities of enrolling university from the students in technological and vocational school. Eventually, the students cannot move up their social status and must stay the laboring class. This case of curriculum have potential power over the hierarchical social status is supported by the ideas discussed in Bowles and Gintis (1976).

The subject in which we can observe the hidden curricula (Giroux, 2001) is biology. Since the Korean government first built up the national curricula, they have developed the Korean curricula by adopting curricula of the United States of America. Likewise, the curriculum for biology was developed by same way. The American biology curriculum divides the sub-disciplines of biology into four sections, which are organismal (zoology and botany), genetics, evolution, and ecology (NRC, 1996). The Korean curriculum also has four sections of biology sections. However, while the American curriculum deals with four sections equally, Korean biology curriculum attaches more importance to organismal section (zoology and botany) and genetics. The instruction of the curriculum clearly singles out the organism and genetics section as areas to be focused on. The basis is that the sections are more strongly related to human life and future than other section.

Traditionally, Korean society has been pragmatic in many areas such as education and policy. Likewise, this pragmatic perspective has influenced science. For instance, many research universities and government research centers attach too much effort to the applied science not pure science. The number of job positions related to pure science has been decreased; thereby many students do not want to enroll the pure science program. The scientist that the Korean society demands is not one who can investigate 'science'

but one who can apply existing knowledge and make new products.

This social-culture climate allows us to understand why the biology curriculum concentrates on the zoology, botany, and genetics sections. On the other hand, many scientists have been concerned about this problem. The Korean government decided to add the stem cell section into biology curriculum five years ago because at that time Korean scientists led stem cell research. One scientist claimed that the Korean biology curriculum was interested in only money and industry not the real science. Many educational philosophers claim that this education is stereotype of a developing country and very an underdeveloped type of education. Thus, the social values and ideology that Korean society pursues are shown in the biology curriculum and Korean students unconsciously learn this ideology even when they learn biology (Giroux, 2001).

Another case in which we can see the social influence on biology curriculum is evolution education in Korea. The social power of the Protestant Church has gradually increased since the religion was established in Korea. Many elite groups of people believe in the Protestant faith. These people have proposed the elimination of the evolution section in the biology curriculum whenever the government reforms the curriculum. Although their fundamental reason is that evolution section is against their beliefs, the basis on which propose to remove evolution is that it is not practical for our life and useless (Jang et al, 2009). Studies regarding social pressure on evolution education have been conducted in US. Their claim is that evolution education weakens individual belief in religion, and therefore weakens the church and their culture. These groups think that evolution education has huge power that can influence their belief system and ideology (Moore, 2008).

Korean biology curriculum is more focused on zoology, botany, and genetics and relatively less focused on evolution and ecology. We can identify this phenomenon in not only the biology curriculum but also in the university entrance examinations test. Although evolution is one part of biology textbook, the frequency of items about evolution in the university entrance examinations test represents just 10% of the biological content (Kim, 2009). Therefore, Korean biology teachers may be pressured to emphasize zoology, botany, and genetics by the Korean biology curriculum and university entrance examinations. Moreover, students may also learn zoology, botany, and genetics as important biological concepts.

This study aims to identify the social influence on Korean biology teachers' perspectives on biology education. In particular, I suggest following three hypotheses and test the hypotheses by conducting a survey.

1. Korean biology teachers believe that zoology, botany, and genetics are more related to human life than other biological subjects.
2. Korean biology teachers believe that zoology, botany, and genetics are more important than other biological subjects.
3. Korean biology teachers make more effort to teach zoology, botany, and genetics than other biological subjects.

II. Theoretical Framing

The initial question raised in this paper was: What are the most important factors acting on curriculum development? Various answers may come from the many different perspectives on this issue. In this paper, I am looking for the factors related to the social perspective.

First of all, the concepts taught in school should have relevance to our life (Abimbola, 1983). The

'our' does not means only human but also all things around us such as ecosystem and abiotic environment. Although a planet outside of the galactic system does not seem to have relevance to our life, the reason we investigate a planet outside of the galactic system is that we are the part of the universe. Likewise, the Korean students do not have to study American political system because American political system does not have direct relevance to Korean students. It is common to eliminate old curriculum or to add new curriculum because of the change of its relevance to society. Environment education was added into Korean curriculum because people knew it is related to our life, which is good case for this.

Second is the value of the curriculum (Abimbola, 1983). Currently, the environment education has been emphasized in science curriculum in the world. This is because people attach more value to environmental issue than profits from the industry. For the past three decades, people have debated what should be more valuable between healthy environment and affluent human life. Through the debate, the value that people pursue has shifted into healthy environment so the advent of the environment education was attributed.

The last factor is the future (Remillard, 1999). The relevance and value of the curriculum is necessary but not sufficient because the learner is the people who live in not only in present but also in future. Even though the curriculum is very valuable in present, it will not be valuable in future. Therefore, curriculum developers should anticipate the change of future and apply the change in the curriculum so that our students can prepare to their future. This is also the role of education.

I have discussed the factors related to curriculum development in terms of social perspective. The relevance, value, and future are the most important in development of curriculum. These factors should also be relatively important in terms of which society we live in. As I mentioned above, Korean society tends to attach more importance to present relevance and value not future. Consequently, this character of Korean society has influenced the biology education.

III. Biological Sub-disciplines and Korean Society

I have discussed on the social influence and important factors in development of curriculum. I will now discuss the biological sub-disciplines and Korean society in this section.

Biology is the discipline concerning life and living organisms. It is very difficult to define modern biology because biology has been branched to many sub-disciplines of biology which are recognized on the basis of organisms and methods (Mayr, 2000). The national science education standards divide biology into four categories which are organisms, genetics, evolution, and ecology (NRC, 1996). The organismal section covers zoology and botany, focusing on the five kingdoms of species.

Although the biology curriculum in the US attaches equal importance into those sub-disciplines in the textbook, the biology curriculum in Korea is very biased toward zoology, botany, and genetics. According to the Korean biology curriculum, the basis of this inequality results from that zoology and botany are much related to human life and that genetics is much related to future biotechnology. Therefore, the high-stake university entrance examination is focused on those disciplines such as zoology, botany, and genetics not evolution and ecology. This disproportionateness of examination results in disproportionateness of teaching those sub-biological disciplines in school.

This unbalanced biology curriculum have had abnormal consequences on biology understanding in Korean society. This abnormality can be identified in recent disaster of livestock industry. Recently, one third number of cows and pigs in Korea died due to the foot-and-mouth disease. Korean society has had this disaster several years ago but due to the lack of experts on this problem, they did not anticipate the recent disaster. The research of animal disease is based on evolutionary and ecological background. The studies on occurrence of the new disease and direction of the disease cannot be conducted without evolutionary and ecological background. experts pointed out that Korean society's disregard of pure science such as evolution and ecology results in the lack of experts on this research area and lack of solutions. We can find the importance of researching pure science in SARS case in China. When severe acute respiratory syndrome (SARS) was occurred in China in 2004, Chinese scientists started to study the mutation and the factors of variation selection and published many papers. The number of publications in journal Science is more than ten publications. These studies continue to the development of treatment of SARS.

Why do not scientists want to study on this issue? This is because the government does not support the scientists who research pure science. Even though Korean society has already had economical affluence, they still have intense aspirations toward development. The more aspirations toward development they have, they attach more value to present not to future. Therefore, Korean society has been interested in the applied science which can make the products soon. They have disregarded the pure science because it cannot make any products quickly. The zoology, in particular, animal physiology and genetics are more related to the applied biology. Especially, the numbers of scientists who are involved in genetics are abnormally abundant in Korea. The statics shows the more than 60% of biologists are involved in genetics in Korea. This is because the genetics is closely related to the biotechnology and medicine industry and make a new product quickly. Therefore, the government invests fewer budgets in pure science such as evolution or ecology; consequently the numbers of biologists in pure science area have decreased.

IV. Methodology

1. Participants

Fifty in-service secondary biology teachers participated in this study. All participants were students of Med. program in Korea. They were not asked what school level they teach currently because Korean teachers are rotated between middle school and high school every four years so they are experienced in both middle and high school teaching. Teachers were asked for their religious affiliation because evolution education is much related to religion, especially Protestant. Participants were 18.0% male and 82.0% female. In terms of religious affiliation, participants self-identified as Buddhists (22.0%), Protestants (16.0%), Roman Catholics (16.0%), and No-religious affiliation (46.0%). The average year of teaching experience was 10.2 years.

2. Instrument

This study employed survey methodology. The survey questionnaire involves three sections, which are: (1) demographic data, (2) 7-point Thurstone scale, and (3) open-response questions. In the scale section, participants evaluate biological concepts-- zoology, botany, genetics,

evolution, and ecology-- based on relevance, value, teaching, and learning (see the appendix). In the open-response section, they wrote up the basis of their evaluation. For the content validity, this instrument was examined one expert (PhD in science education) and PhD students in Korea.

3. Data Analysis

To identify my hypotheses, I used ANOVA to compare the score of each biological concept. For the open-responses, the main terms that teachers used for the responses were extracted and compared. In particular, three main terms of each category were shown in the table.

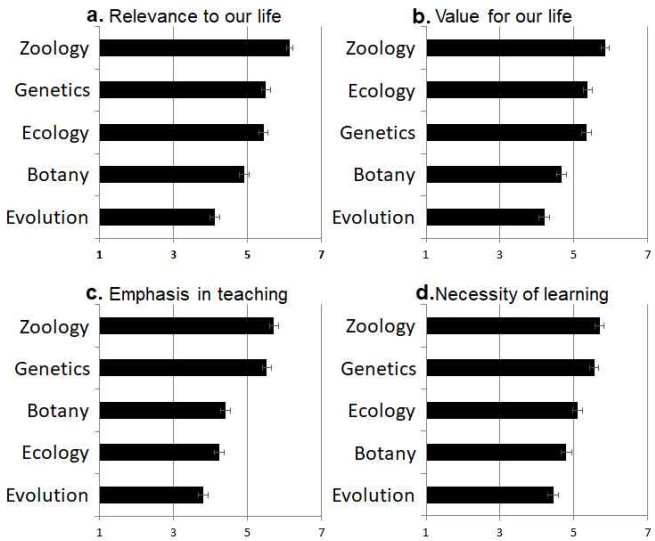
V. Results

To identify hypothesis 1 for the relevance, the score of the level of relevance to our life were zoology (6.1), genetics (5.5), ecology (5.4), botany (4.9), and evolution (4.1) (see figure 1a). The Repeated Measure of ANOVA shows significant difference (F[4, 46] = 26.445, p = 0.000, Partial Eta Squared = 0.697). The first hypothesis that Korean biology teachers believe that zoology, botany, and genetics are more related to human life than other biological subjects was supported by the result. Korean biology teachers acknowledged zoology is most related to our life and evolution is least related to our life.

The results of score on value for our life were zoology (5.9), ecology (5.4), genetics (5.3), botany (4.7), and evolution (4.2) (see the figure 1b). Therefore, the second hypothesis that Korean biology teachers believe that zoology, botany, and genetics are more important than other biological subjects was also supported to the result. The Repeated Measure of ANOVA shows significant difference (F[4, 46] = 23.962, p = 0.000, Partial Eta Squared = 0.676).

In terms of the emphasis in teaching, the levels of each biological concept were zoology (5.7), genetics (5.5), botany (4.4), ecology (4.2), and evolution (3.8). The Repeated Measure of ANOVA shows significant difference (F[4, 46] = 25.409, p = 0.000, Partial Eta Squared = 0.688).

The levels of necessity of learning that teachers thought were zoology (5.7), genetics (5.6), ecology (5.1), botany (4.8), and evolution (4.4). This result supported the third hypothesis that Korean biology teachers make more effort to teach zoology, botany, and genetics than other biological subjects. The Repeated Measure of ANOVA shows significant difference (F[4, 46] = 13.958, p = 0.000, Partial Eta Squared = 0.548).



[Figure 1] The mean value of the level of each category

The most common terms that biology teachers mentioned is 'health.' Other common terms such as medicine, disease, and leisure are also related to human life. Biology teachers did not respond the relating word to human life in evolution. It is interesting to note that examination and curriculum are most influencing factor in their teaching and learning <Table 1>.

<Table 1> The terms in the responses of each question

	Relevance to our life	Value for our life	Emphasis in teaching	Necessity of learning
Animal	Health Medicine Disease	Health Disease Commonsense	Examination Curriculum Commonsense	Health Examination Commonsense
Plant	Food resource Leisure Oxygen	Dietary Life Producer Agriculture	Examination Curriculum Agriculture	Examination Agriculture Curriculum
Genetics	Disease Medicine Biotechnology	Medicine Biotechnology Future	Examination Curriculum Disease	Examination Curriculum Disease
Evolution	No relation Curiosity Theory	Biodiversity Theory Future	Examination Curriculum Religion	Examination Curriculum Commonsense
Ecology	Environment Pollution Disease	Environment Pollution Biodiversity	Examination Curriculum Environment	Environment Pollution Curriculum

VI. Discussion

I discuss the results with three factors that I mentioned above -- relevance, value, and future --. First is relevance. The responses of Korean biology teachers show that zoology is more related to human life and evolution is less related to it. Moreover, Korean biology teachers have very human-centered idea in the understanding of biology. They addressed anthropocentric terms such as leisure, oxygen, pollution in even botany and ecology. Korean biology teachers may have been influenced by the Korean curriculum which is human centered. Likewise, they did not find the relevance between evolution and human life. This may be because that the curriculum has taught evolution as just a theory not a practical biological explanation. Koreans should have more understanding of evolution based on modern biological perspective.

Second is the value. Although ecology was ranked in second, it is important to note that Korean biology teachers recognize the value of ecology education. The results that Korean biology teachers recognize the value of ecology is interpreted by recent increased concern about environmental issue. Although ecology is not yet recognized as a main topic in curriculum, Korean biology teachers acknowledge the potential importance of teaching ecology in school. Moreover, due to the recent food crisis and animal disease disaster, Korean biology teachers are concerned about ecology.

Last is the future. What is the good future that Korean biology teachers pursue? The terms that participants addressed show that examination has overwhelming power of their teaching. Korean biology teachers may think that making students prepared to examination is top priority of their job; therefore, the curriculum and examination have very large impact on their teaching. Existence and nonexistence of items in examination seem to be the most important criteria to evaluate the subject. Although the curriculum and examination are not purpose of teaching and learning, very competitive social atmosphere of Korean society may influence teachers' idea.

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Appendix: Example of Questionnaire Item

Please choose one option based on your opinion. Based on the value for our life, please evaluate following five biological concepts.

Biological concepts	No value	A little	Some what	Valua ble	Much	Very much	Enorm ously
Zoology							
Botany							
Genetics							
Evolution							
Ecology							

Please write up the basis of your evaluation above.

Zoology:
Botany:
Genetics:
Evolution:
Ecology: