



The Analysis of Pre-service Elementary Teachers' Perception on Biology Inquiry Subjects, and biology Materials in the Korea Elementary School Science Textbook

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한국의 초등 과학 교과서 생명영역에 나오는 탐구 주제 및 생물 재료에 대한 초등 예비교사들의 인식 분석

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Abstract

The aim of this study was to analyze a group of pre-service elementary teachers experience on the cognitive terms of biology inquiry subjects, and experience on living materials related with the domain of life in the Korea elementary school science textbook. Firstly, elementary school pre-service teachers had the confidence of inquiry subjects related with the domain of life such as 'when we take breath what will happen in human body?' and 'Can we make the model of human body?' But they did have the most diffidence of 'The search for *pieris rapae*, a cabbage butterfly's life', 'Can we grow the little creature?' The reason why pre-service elementary teachers had diffidence of comprehending experiment procedure and planning ability was that 'they focused on understanding the scientific concepts instead of planning experiments by themselves', and 'they carried out the least amount of experiments' Secondly, elementary school pre-service teachers had never experienced biology materials related with the domain of life in the Korea elementary school biology science textbook such as '*tradescantia reflexa*', 'Caddis larva', 'hydrilla verticillata', and 'Plantain lily.' According to the findings obtained from the study, the reason why they had never seen the biology materials was that they had the least opportunity of immediately observing life creatures due to memorization-intensive classes.

Key words : Pre-service elementary teachers, Biology inquiry subjects, Biology materials, Science textbook

I. INTRODUCTION

The aim and procedure of the experiment should be comprehended, and the experiment should be executed depending on their ability level related with the various inquiry activity including

observation, experiment, search, discussion and etc. in the Korea Science curriculum (MEST, 2011). Furthermore, solving the problem as one of the science process skills improve the students' inquiry ability by connecting with the learning content in the science.

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Many science educators have indicated that experiment improve conceptual perception and inquiry perception, and have a positive effect on scientific attitude of scientific nature and motivation (Lee *et al.*, 2011). In other words, experiment help students comprehend scientific concepts, method, and scientific activity and participate in science class with the attitude of interest and passion (Park *et al.*, 2009). Moreover, experiment in science is a strategy as a significant role for achieving each thematic learning objectives and as a teaching & learning method of unique features that can't be found in the other subjects.

Despite these unique characteristics, the reason why experiment in the school is implemented by a simple laboratory brochure like a step by step cookbook is that teachers and students don't have adequate comprehension of science experiment, the purpose and usage of the science experiment (Jeong & Hong, 2004). Another reason is that teachers have much difficulty of obtaining thematic experiment materials and achieving thematic learning objectives.

One of the ways to increase teaching efficiency in science is teachers' ability (Mihladić & Timur, 2011). Teachers' ability help the students achieve learning objectives. So that teachers can instruct science experiment, it is necessarily required for them to have the competence of implementing the experiments shown in science textbook with their own hands-on lab skills (Park *et al.*, 2008). As a result, teachers' implementing many various experiments shown in science textbook without fear persuade students to take an active part in science class with a positive attitude.

Inquiry activity is emphasized in the textbook of the Korea Science curriculum, many various laboratory equipment and materials are shown with

inquiry thematic objectives. That is, teachers should have adequate competence of perception and inquiry thematic objectives for students' active participation and crucial student-centered activities. Therefore, analyzing teachers' confidence of various experiments shown in the science textbook is meaningful for achieving science education objectives and revitalizing science experiments on the spot.

According to Costu *et al.* (2005) and Cuevas *et al.* (2005), it seems that most pre-service teachers think themselves inappropriate for using experiment tools and materials because of problems they came to have during the educational process of teacher training institutes. This finding shows how important a teacher educational process is and that education should focus on helping pre-service teachers have confidence in experiments.

In particular, biology includes various concepts of mutual complexity as a sort of science (Atav & Altunoglu, 2010). Experiment and observation consist of biology's concepts, and connects each concepts as an essential component (Jeanpierre, 2006). Therefore, this thesis aims to analyze why pre-service elementary teachers have difficulty in inquiry subjects related with the domain of life, and find out the necessary way to improve their competence for the Korea elementary school biology education.

From now on, research of pre-service elementary teachers' and current teachers' perception on the names and usage of laboratory equipment (Kim & Lee, 2004; Yeo & Lee, 2004), pre-service elementary teachers' laboratory equipment manipulation ability research was executed (Lee *et al.*, 2011).

This research seems to aim at how pre-service teachers instruct students the way of laboratory equipment, materials and inquiry activity shown in

the textbook.

However, it is hard to find a research that investigated pre-service teachers' confidence in inquiry topics and their understanding about experiment materials.

So this study aims at analyzing pre-service elementary teachers' perception on inquiry subjects, and experience on biology materials related with the domain of life in the Korea elementary school biology science textbook.

The research findings of this study provide us specific information on what kind of experiment should be executed and how experiment should be taught for pre-service elementary teachers in national university of education.

II . METHODOLOGY

1. Participants

As research subjects, this study selected 175 juniors from a university of education located in Metropolitan City, Korea. When they were freshmen, they completed an introduction to natural science as an experiment practice course, and when they were in the first semester as juniors, they completed elementary science education as a school subject theory course. Besides, as juniors in the second semester, they are taking a class of science subject teaching materials and methods at present.

According to the survey result of the experimental students, the ratio of men to women was 59 to 116. Korean high school education offered two different curriculum tracks[options]: liberal arts and natural sciences. The ratio of liberal arts to natural sciences was 124 to 51. The ratio of Advanced course, Biology I to Biology II was 47

to 18 <Table 1>.

<Table 1> Research object

Gender		Curriculum options		Biology I	Biology II	
Men	Women	Liberal arts	Natural sciences			
N	59	116	124	51	47	18

2. Data collection & Analysis

First of all, for inquiry topics and biology materials as research targets, this study analyzed and selected science textbooks for third to sixth grade-students, published according to the 2007 and 2009 revised curriculum. It was to consider both the curriculum provided at the point of time when this study started and the a future curriculum when pre-service teachers start working for school as elementary teachers.

All the survey questions were qualified through three consultations of 4 elementary teachers and 1 science education specialist. Out of all the elementary science inquiry activities, they selected science experiments that elementary students find difficult and inquiry topics that should be necessarily given in form of inquiry experiment in class, based on their experiences of teaching science as well as biology materials that are mostly used for science textbook inquiry activities. At last, the questionnaire was composed of two kinds of questions, one to analyze pre-service teachers' confidence in each topic and the other to examine pre-service teachers' experience of using biology materials <Table 2, 3>.

<Table 2> The names of biology materials shown in biology inquiry activities of elementary school textbook

Grade	Chapter	biology materials
3	Animals' Life Cycle/	chicken, artogeia rapae linnaeus, kale, brassica oleracea var. capitata(cabbage)
	Animals' World/Animals' Life	earthworm, land snail, planaria, mosquito larva, water strider, caddis larva, tiger swallowtail, moth, ant, lady beetle, mosquito, frog, fly, melanian snail
	Plants' Life Cycle	phaseolus vulgrais var, corn
4	Plants' World/Plants' Life	hepaticophyta, hair moss, pear, peach, apple, tiger lily, brassica napus, potato, lily, ginko, lobedleaf pharbitis, tradescantia reflexa, forsythia koreana, camellia japonica, bambusoideae, pine, zelvova serrata, sunflower, tomato, spirodela polyrhiza, juglans regia, japanese Maple, rice, setaria viridis, pine, peach, pasqueflower, convallaria majalis, cherry blossoms, lotus, persimmon, japanese wisteria, tiger lily, japanese lady bell, strawberry, magnolia, chenopodium album, plantain lily, common Water hyacinth(eichhornia crassipes), cactus, commelina communis, brassica rapa var. glabra(chinese cabbage), mustard, sunflower, robinia pseudoacacia, black locust, chrysanthemum
5	Plants' Structure and Functions	carrot, onion, celeri
6	Ecosystem and Environment/Living Organisms and Environment	water flea
	Living Organisms and Our Life	chlorophyta, hydrilla verticillata, mold, yeast

<Table 3> The competence questionnaire

domain	question
Inquiry subjects	1. How confident are you at teaching elementary school students? Check \checkmark .
	1) What is inquiry without experience?
	2) What do you think the most difficult inquiry is?
living material	3) Why do you think you are not competent in the light of inquiry method comprehension and planning competence?
	2. How well do you know living things shown textbook inquiry activity?
	1) What is the living things you have never seen of? Write the names of 5 living materials you have never seen.
	2) What is the reason you don't know the living things?

The responses were on a 5-point Likert type scale, ranging from 5 (quite confident) to 1 (not confident). The answers of inquiry subjects were grouped in a 5-point Likert type scale: 5: Quite

confident, 4: Very confident, 3: Partially confident, 2: Barely confident and 1: Not confident. The relationship between pre-service teachers' scores was determined by using the average of each component. Write-out answer about open-ended questions inquiring the reason was demanded in the scope of the question of pre-service teachers' confidence except the question on the confidence of inquiry subjects, and biology materials. The time of write-out answer about open-ended questions inquiring the reason is 35 minutes. The research findings is categorized by frequency analysis and set down by items. The response rate of frequency analysis was more than 4%.

4 elementary school teachers and 1 science education specialist participated in the analysis of the survey data on the pre-service teachers. The survey findings was categorized through tertiary analysis respectively by 4 elementary school teachers and 1 science education specialist.

III. FINDING and DISCUSSION

1. The survey result of pre-service teachers' confidence of biology inquiry subject in elementary school textbook

The survey result of pre-service teachers' confidence of biology inquiry subject in elementary school textbook was like <Table 4> as follows.

Pre-service teachers responded that they were quite confident of the checklist such as 'When we breathe, what happen to our body? (respiration organ inquiry),' 'Let's make a human model. (set a human bone and skeleton),' and 'Let's find out the structure and the ecology of a carrot root.' shown in Chapter 'Plant's Structure and Functions' for the

fifth graders. Pre-service teachers responded they were confident of biology lab related with normal life, and preferred very simple lab equipment.

However, Pre-service teachers responded that they were not confident of a long-term biology observation experiment and a biology lab difficult of preparing the material such as 'pieris rapae, a cabbage butterfly's life and growth process,' 'Let's raise the little creature. (ant, mold, moss),' 'Let's find out the growth process and the ecology of a frog.' shown in Chapter 'Animals' Life Cycle' for the third graders.

It is also required to improve lab environment equipment and materials, to expand budget to operate labs, to assign enough time to complete the whole experimental procedure. According to these findings, there are some experimental contents that are difficult to be completed within one hour and some experiments are even ambiguous in their results. So it is suggested to establish a long-term scheme as soon as possible and to supplement it with specialized plans, and within enough time to complete the experiments for pre-service teachers' confidence of biology lab.

1) The survey result of inquiry subject pre-service teachers didn't experience

The survey result of Inquiry subject pre-service teachers didn't experience was like <Table 5> as follows.

Most pre-service teachers responded that they didn't experience a biology experiment related with inquiry subject such as 'Let's raise the little creature. (ant, mold, moss),' 'pieris rapae, a cabbage butterfly's life and growth process,' 'Let's find out the growth process and the ecology of a frog.' These findings suggested the co-relation between biology lab usage, experiment method and

<Table 4> The survey result of pre-service teachers' confidence of biology inquiry subject in elementary school textbook

Inquiry Subject	quite confident	very confident	confident	barely confident	not confident	Number	Score	Average
Let's make simple water purifier	18	22	60	42	33	175	475	2.71
Let's find out the growth process and the ecology of a frog.	6	18	59	70	22	175	441	2.52
Shall we find out the structure and ecology of a flower?	19	31	66	40	19	175	516	2.95
Let's find out the structure and the ecology of a carrot root.	23	58	53	22	19	175	569	3.25
Let's categorize the features of animals. (animal classification activity)	20	36	55	38	26	175	511	2.92
Let's find out the ecology of microorganism in the earth. (collection, observation)	23	40	56	35	21	175	534	3.05
Let's find out the ecology of microorganism in the water. (collection, observation - chlorophyta, water flea, Spirodela polyrhiza, planaria)	20	39	62	33	21	175	529	3.02
Let's find out the features of animals under the sea.	19	36	66	33	21	175	524	2.99
The search for pieris rapae, a cabbage butterfly's life	2	13	70	61	29	175	423	2.42
Let's find out the function of bone and muscle. (making the model of bone and muscle)	10	27	50	59	29	175	455	2.60
The inquiry experiment of a living thing affected by non-biological environment (bean sprouts supplied by sunlight and water and bean sprouts not supplied by sunlight and water)	17	43	70	29	16	175	541	3.09
When we breathe, what happen to our body? (respiration organ inquiry)	30	69	45	21	10	175	613	3.50
Let's find out the growth process and the ecology of a plant. (the ecology of bean)	15	40	58	43	19	175	514	2.94
Let's find out the ecology of a plant and the observation of a plant (the comparison of a grass and a tree, the comparison of plantain lily and Common Water Hyacinth, the observation of a plant in a pond and in the river)	10	31	66	47	21	175	487	2.78
What is the function of a heart? (a petroleum injection and a heart activity)	15	40	51	39	30	175	496	2.83
Let's find out the condition and the ecology of a seed.	24	56	46	28	21	175	559	3.19
Let's find out the function and the ecology of an onion root.	19	33	51	44	28	175	496	2.83
Shall we find out the structure and the function of a fruit.	20	58	56	20	21	175	561	3.21
What happen when we eat food? (food organ inquiry)	24	60	55	21	15	175	582	3.33
Let's make a human model. (set a human bone and skeleton)	30	54	51	29	11	175	588	3.36
what happen when the leaf of the plant absorb the water? (transpiration experiment)	16	38	71	31	19	175	526	3.01
What is a material when the leaf of a plant photosynthesize? (starch detection experiment)	20	40	67	28	20	175	537	3.07
What is the structure of a leaf?	24	43	62	27	19	175	551	3.15
How do our body respond when our body meet the stimulus? (a blue flag and a white flag game)	20	25	64	49	17	175	507	2.90
Let's raise the little creature. (ant, mold, moss)	3	13	67	66	26	175	426	2.43
How does water move through the leaves of a plant?	24	42	50	50	8	174	546	3.12
What kind of effect does the environment pollution have on living things? (the seed experiment in water and sulfuric acid)	13	29	55	43	35	175	467	2.67
Total							517	2.96

<Table 5> The survey result of inquiry subject pre-service teachers didn't experience

Inquiry subjects	N(%)
Let's raise the little creature.(ant, mold, moss)	87(49.71)
The search for pieris rapae, a cabbage butterfly's life	85(48.57)
Let's find out the growth process and the ecology of a frog	77(44.00)
Let's find out the function of bone and muscle. (making the model of bone and muscle)	70(40.00)
What kind of effect does the environment pollution have on living things? (the seed experiment in water and sulfuric acid)	66(37.71)
Let's make simple water purifier	64(36.57)
Let's find out the ecology of a plant and the observation of a plant (the comparison of a grass and a tree, the comparison of plantain lily and Common Water Hyacinth, the observation of a plant in a pond and in the river)	60(34.29)
What is the function of a heart? (a petroleum injection and a heart activity)	60(34.29)
Let's find out the function and the ecology of a onion root.	55(31.43)
How do our body respond when our body meet the stimulus? (a blue flag and a white flag game)	49(28.00)

design. The results show that most pre-service teachers lack experience of conducting experiments that they are not confident. As all the experiments presented in textbooks should be conducted under teachers' instructions at an actual teaching site, however, they should conduct the experiments in advance.

Teachers' abilities to carry out experiment lesson successfully depended on teachers' abilities to find out students' characteristics and teaching skills related with biology lab classes (Park *et al.*, 2009). That is, biology lab class teaching skills means that teachers should have various experimental experiences, and carry out lab classes. Teachers' experience to carry out experiment lesson successfully could help teachers instruct what students observed and measured. Skilled and experienced teachers could solve the question and problems through feedback during biology lab classes.

2) The survey result of Inquiry subject difficult

of pre-service teachers' carry-out

Inquiry subject difficult of pre-service teachers' carry-out was 'pieris rapae, a cabbage butterfly's life and growth process,' and 'Let's find out the growth process and the ecology of a frog.' Pre-service teachers responded that they were not confident of a long-term biology observation experiment <Table 6>. The reason is that they are not confident of biology lab result due to a long-term observation experiment and many variables.

Teachers should be confident of education material access method, and one of the best method should be real experience-based or inquiry-oriented way (Baumgartner, 2010). If skillful and experienced teachers instruct, students can easily comprehend inquiry biology lab.

Teachers should help students learn the simple content knowledge and scientific inquiry skills, and provide students with more opportunity of using what they learned (Supovitz & Turner, 2000).

<Table 6> The survey result of Inquiry subject difficult of pre-service teachers' carry-out

Inquiry Subjects	N(%)
Pieris rapae, a cabbage butterfly's life and growth process	40(22.86)
Let's find out the growth process and the ecology of a frog	30(17.14)
Let's categorize the features of animals. (animal classification activity)	23(13.14)
Let's raise the little creature.(ant, mold, moss)	22(12.57)
What kind of effect does the environment pollution have on living things? (the seed experiment in water and sulfuric acid)	16(9.14)
Let's find out the features of animals under the sea.	15(8.57)
Let's find out the growth process and the ecology of a plant. (the ecology of bean)	13(7.43)
Shall we find out the structure and ecology of a flower?	8(4.57)
Let's find out the ecology of a plant and the observation of a plant (the comparison of a grass and a tree, the comparison of plantain lily and Common Water Hyacinth, the observation of a plant in a pond and in the river)	8(4.57)

Also, as there are not proper guideline including the explanation of various scientific ununderstandable phenomena during experimental classes, many teachers can't deal with ununderstandable phenomena, and lose the effectiveness of scientific inquiry. Moreover, it is difficult to complete biology lab within one hour (MEST, 2011). So teachers should be competent at preparing, processing, carrying out experiment, and drawing a conclusion of meaningful lab results.

3) The survey result of inquiry method comprehending and planning incompetence

The survey result of inquiry method comprehending and planning incompetence was like <Table 7> as follows.

Pre-service teachers responded that the reason was 'they just focused on understanding the scientific concepts instead of planning experiments by themselves.'

The result of pre-service teachers' response indicated that about 70% of the difficulty of comprehending experiment method and lab design

was one of the most significant reason. Furthermore, the lack of sufficient equipment and scientific interest led to inquiry method comprehending and planning incompetence. These difficulties was due to emphasizing experiment process that pre-service teachers have never carried out, and due to focusing on a step by step laboratory brochure and successive scientific inquiry method guidelines that requires oversimplification (Windschitl & Thompson, 2006).

However, science teachers should undergo and predict all the possible situations during science lab process (Park *et al.*, 2009). Hashweh (1985) indicated that most teachers with adequate competence of science content implemented various scientific activities, but others with inadequate competence just followed the process of textbook. In addition, Zembel-Saul *et al.* (2002) suggested that pre-service teachers with basic knowledge didn't have enough scientific inquiry skills and inquiry process abilities for various situations. Especially, if pre-service teachers didn't show

<Table 7> The survey result of inquiry method comprehending and planning incompetence

Response	N(%)
Pre-service teachers focused on understanding the scientific concepts instead of planning experiments by themselves.	35(20.00)
Pre-service teachers carried out the least amount of experiments.	27(15.43)
Pre-service teachers are used to obtaining the result-oriented classes instead of biology lab process.	23(13.14)
Pre-service teachers have never heard of experiment method and design caution when they did not prefer carrying out experiment in elementary school years.	22(12.57)
Due to insufficient equipment in school lab	13(7.43)
Pre-service teachers just followed their instructor during biology lab in their elementary school years.	12(6.86)
Pre-service teachers didn't comprehend the exact purpose of the experiment and variables control.	11(6.29)
Pre-service teachers just memorized the lab procedure and method for the exam-oriented studying.	8(4.57)
Pre-service teachers didn't undergo many trials and errors.	8(4.57)
Pre-service teachers are short of intelligent interest to research something new.	8(4.57)
Pre-service teachers didn't make an effort.	8(4.57)

practicality of difficult scientific experiment, they would not try new method (Moore, 2003). As a result, it is necessary to develop new educational method with effectiveness and better experimental textbooks for solving these problems. It is also required to put new methods in the curriculum and make constant efforts together to provide the better education textbook for various science lab.

2. The survey result of biology inquiry activities in elementary school textbook

1) The survey result of the living creatures pre-service teachers have never seen

<Table 8> showed the names of the living creatures pre-service teachers had never seen in biology inquiry activities of elementary school textbook was 'tradescantia reflexa', 'caddis larva', 'hydrilla verticillata', and 'plantain lily.'

According to the survey result, as the living

creatures pre-service teachers had never seen in elementary school textbook were included in inquiry activities, the experiment of these creatures could be avoided. Also, in spite of using real living things, the pictures of these creatures could be used.

Therefore, the more opportunity should be given to comprehend experiment in the textbook and scientific phenomenon, and implement successful experiment by using the living creatures and supplying or collecting living thing materials.

2) The survey result of the living creatures pre-service teachers have never known

It was stated that pre-service teachers studied for the exam-oriented classes, and lab classes should not be properly implemented according to the survey related with various lab experienced programs (Kim, 2014; Moon & Kim, 2008).

<Table 8> The names of the living creatures pre-service teachers had never seen

The living creatures	N(%)	The living creatures	N(%)
tradescantia reflexa	79(45.14)	mosquito larva	35(20.00)
caddis larva	75(42.86)	hepaticophyta	25(14.29)
hydrilla verticillata	68(38.86)	false acasia	23(13.14)
plantain lily	64(36.57)	chlorophyta	22(12.57)
hair moss	55(31.43)	planaria	21(12.00)
tiger lily	47(26.86)	yeast	20(11.43)
goosefoot	44(25.14)	spirodela polyrhiza	19(10.86)
celeri	43(24.57)	juglans sinensis DODE	16(9.14)
a lily of the valley	39(22.29)	japanese lady bell	9(5.14)
kale	37(21.14)	pasqueflower	9(5.14)
water flea	35(20.00)		

<Table 9> indicated the memorization-oriented classes as an education system that was focused around cramming and memorization caused pre-service teachers not to be acquainted with the names of the living things.

The curriculum had an emphasis on the inquiry-oriented science education, but the real experiment implemented in the school was limited. If teachers didn't have any experience of

meaningful experiment for living things, they couldn't provide more practical opportunity and meaningful lab experience to students.

Biology experiment by using not living creatures but pictures of science textbook decreased the effectiveness of science education (Byeon & Bail, 2008; Dickerson *et al.*, 2006). If students ask not the textbook's questions but unexpected questions, teachers can have difficulty of answering the

<Table 9> The survey result of the living creatures pre-service teachers have never known

Response	N(%)
Pre-service teachers studied for the memorization-intensive classes.	36(20.57)
Pre-service teachers didn't observe the plants and animals carefully.	32(18.29)
Pre-service teachers didn't see the living creatures during science classes.	23(13.14)
Pre-service teachers didn't have any interest in inquiry activities.	21(12.00)
No one instructed pre-service teachers the exact names of the living creatures when they saw them in the nature.	19(10.86)
Pre-service teachers couldn't see the living creatures in the city due to the polluted environment.	18(10.29)
It was easy to learn the living things by using their pictures.	17(9.71)
They just implemented the experiment of specifically appointed living things.	9(5.14)

substantial science inquiry (Baumgartner, 2010; Kim, 2017; Park, 2014). Therefore, teachers should be interested in living creatures and gain an opportunity of actively collecting biology materials for achieving the purpose of science experiments.

IV. CONCLUSION and SUGGESTION

This study had its purpose in analyzing pre-service elementary teachers' experience on the cognitive terms of biology inquiry subjects, and experience on living materials related with the domain of life in the Korea elementary school science textbook.

The followings were the summarizations of the main issues of the study:

First, pre-service elementary teachers have the confidence of inquiry subjects related with the domain of life such as 'when we take breath what will happen in human body?' and 'Can we make the model of human body?' But they did have the most diffidence of 'the search for the growth process of *Pieris rapae*, a cabbage butterfly's life', 'Can we grow the little creature?' This is the same survey result of the inexperienced experiment. The most difficult experiment of implementing hands-on lab is 'the search for the growth process of *Pieris rapae*, a cabbage butterfly's life', 'Let's find out the growth process of a frog's life.' The reason is that they are not confident of biology lab due to a long-term observation experiment. The reason why pre-service elementary teachers were not competent of comprehending experiment procedure and planning lab is that 'they focused on understanding the scientific concepts instead of planning experiments by themselves', and 'they carried out the least amount of experiments.' Besides, teacher training institutes should provide appropriate

programs through which pre-service elementary teacher can experience various experiments.

Second, pre-service elementary teachers have never experienced biology materials related with the domain of life in the Korea elementary school biology science textbook such as '*Tradescantia reflexa*', 'caddis larva', '*Hydrilla verticillata*', and 'plantain lily.' According to the findings obtained from the study, the reason why they have never seen the biology materials is that they had the least opportunity of immediately observing life creatures due to memorization-intensive classes.

Given the findings of the study, there are some suggestions:

Firstly, pre-service teachers in Korea elementary school recognize the difficulty of teaching students elementary science during 1-2 weeks of pre-service teacher's teaching practice program. It is essential to rearrange the university curriculum in which pre-service teachers can immediately implement biology lab for inquiry activities shown in elementary school textbook through this teaching practice program experience. It is also necessary to add the university curriculum for sharing the information on the difficulty of application with each other. This study has a limitation in generalizing pre-service elementary teachers' understanding about biology inquiry topics and biology materials. Therefore, further studies should analyze differences in their understanding about biology inquiry topics and biology materials according to their gender, whether they completed high school courses, and how many biology courses they completed.

Secondly, pre-service teachers' confidence and attitude of science had a positive effect on their confidence and attitude of science when they are their in-service teachers in the near future. As a

result, it is necessary to develop new experiment educational programs with effectiveness and build up the better condition of experimental tools and lab materials for elementary inquiry subjects. It also provides more opportunities to observe and use immediately experiment materials. It is also required to develop new estimation methods of experiment practice competence for lab classes, and to supply pre-service teachers better opportunity of feedback on their experiment competence through self-reflection.

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