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An Exploring of Active Learning Management in Science Class by Using Question

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Abstract: The aim of this study was to explore pre-service teachers teaching in science class by using question. Two pre-service teachers from Khon Kean University were selected to be a case study. This study we employed qualities method which is a case-study research. The beginning of collecting data starts from investigations of questions in lesson plans. Then, we observed two pre-service teachers' teaching in class and interviewed their students. The lesson plans of questing were analyzed with five characteristics of questions, including; 1) comparison, 2) cause and effect, 3) prediction, 4) exploratory, and 5) design and make. Data from observation classroom was analyzed about characteristics of active learning with active learning criteria and data from the interview were grouped and interpreted. The results found that two pre-service teachers (PST-A and PST-B) used four types of question to ask students in science class were; comparison, 2) cause and effect, 3) prediction, and 4) exploratory. Each type of question prompted the students learn science as active learning as follows;

- Type of comparison question prompted the students observe and discuss in order to compare the differences of two subjects.
- Type of a cause and effect question prompted the students' analyses a causing of phenomena that occurring and discuss to find the relationship of causing.
- Type of prediction question prompted the students observe and predict, which it brings the students to do experience.
- Type of exploration question prompted the students explore and observe something to discuss and present from exploring.

Keywords: Types of question, Active learning, Science class

1. Introduction

The question is a frequent component of classroom talk and stimulate students' thinking, which provide the teacher to can feedback about students' understanding about scientific knowledge (Chin, 2007). In addition, the questioning is the most frequently use instructional tool. Actually, there are some problem of teachers teaching by using question in a low-level of asking questions, which the students get the knowledge as memory. This teaching style is a not good teaching, since it prompt students' lack of active learning in science class. Consequently, a good teaching, teacher needs to raise a question in a different levels for students learning in class (Chin, 2002; 2006; 2007) in order to students interact and participate in doing an activity and learning. This teaching style is an encouraging the students to learn with active learning.

In active learning, the teacher needs to encourage the students to engage in the learning process and participate in doing an activity of the learning. In addition, teacher enhance students to collaborate in learning that providing them to interact with classmates. Furthermore, the active learning, student constructs meaning of science contents through teacher ask questions, which prompt them have discussion, analysis about the contents from question before they answer (Bonwell & Eison, 1991; Michaek, 2006; Akinoglu & Tandogan, 2007 and Vickery, 2014). This a reason point to see that in asking questions are playing an important role for the teacher need to use in teaching students in science class. Moreover, the using questions to ask students in science class is very important to embed in the mine of in-service teachers to construct an actionable activity in class, since they were pre-service

teacher. Therefore, pre-service teachers must to use the asking questions to teach students in science class in order to develop the teaching in science class to become active learning.

In Thailand, the pre-service teachers have studied four-years of coursework and spend a year for practicum to gain field experience in school. There were problems that occur in their teaching and learning such as lesson planning techniques, teaching strategies, student learning processes and incorporation of instructional material (Faikhamta, Jantarakantee & Roadrangka, 2011). In addition, in the real situation of teaching in school, pre-service teachers are difficulty in creating teaching activities for students' learning. They do not know how they start teaching to encourage the students to learn science with active learning. However, In 2018, there are founding a four factors of training pre-service teachers in professionally, teaching science, including: Question, Discussion, Observation and Reflection (Ruhaisa & Huntula, 2018) to train pre-service teachers to enhance in creating active learning in teaching science. Moreover, the factor of Question is a way to help pre-service teachers manage their own teaching and learning. Consequently, in this study, we want to know how pre-service teachers use the question to teach students in science class in order to explore students' learning as active learning by using questions from pre-service teachers' teaching in science class.

2. Methodology

Two pre-service teachers from Khon Kean University, who teaches students studying in the five years of study and practicing in the school for one year, were selected to be a case study. They were selected by their supervisor guiding when they studied in micro-teaching for four years of study, they were used a question in teaching activity. In this study, we employed a qualities method which is a case-study research from Creswell, 2003.

2.1 Data collation

The beginning of the study, we start from investigations about a questions on lesson plans, two lesson plans were investigated. Then, two pre-service teachers, PST-A and PST-B, were observed in class about using types of question in teaching science for two times as shown in table 1. The finally of collating the data, three students were interviewed about what students are felling after pre-service teachers, PST-A and PST-B, used the questions to ask them in during the learning.

Table 1
The collecting data of teaching and learning in science class

Pre-service teachers (PSTs)	Lesson plans		Topics	Time (min)
PST-A	1	-	Fossils	50
	2	-	Dinosaurs in Thailand and extinction of living thing	100
PST-B	1	-	Factors of photosynthesis (light and chlorophyll)	100
	2	-	Factors of the qualitative of water	50

2.2 Data analysis

The lesson plans of pre-service teachers, PST-A and PST-B, raise the types of questions to teach students in science class were analyzed with five characteristics of questions (Chin, 2002; 2006 and 2007), including; 1) comparison questions, 2) cause and effect questions, 3) prediction question, 4) exploratory question, and 5) design and make questions as shown in table 2, criteria five types of question.

Table 2
Criteria five types of question

Kinds of questions	Questions index	Explanation of questions index
Comparison question	- Observe, discuss and compare something to find differences.	- Teacher requires students to observe and discuss the differences among two or more than two something and compare differences of something.
Cause and effect question	- Analyze and discuss about a causing of phenomena and find a reason of causing and affection.	- Teacher requires students to analysis a causing of phenomena that occurring and discuss to find the relationship of causing was occurring.
Prediction question	- Observe, predict and discuss before they do an experiment or before they study.	- Teacher requires students to observe and predict before they do experience and provide students discuss of prediction.
Exploratory questions	- Explore and observe in what about we want to know, and present what they be found.	- Teacher provide students to explore something and requires students to observe and present from exploring.
Design /make questions	- Design and create something by themselves.	- Teacher requires students to create and build something by themselves.

(Ref. Christine Chin, 2002, 2006, 2007)

Data from observation classroom was analyzed about characteristics of active learning with active learning criteria (Bonwell & Eison, 1991) as shown in table 3. The data from the students' interviews were grouped word and interested. In this study, we used triangulation to control the quality of the study.

Table 3
Criteria the characteristics of active learning

Active learning contents	Characteristics of active learning
- Students are involved in more than listening.	- Interaction and collaboration
- Less emphasis is placed on transmitting information and more on development of students' skills.	- Practicing
- Students are involved in higher order thinking.	- Analysis, synthesis
- Students are engaged in activities	- Writing, discussing, observing, brainstorming
- Greater emphasis is placed on students' exploration of their attitudes and values	- Presenting

(Ref. Bonwell & Eison, 1991)

3. Results and discussion

Results from exploring of a case study, PST-A and PST-B, used the questions in teaching science by investigation a question on lesson plans and observation class found that they were used the questions to teach students in class. The teaching prompted the students interacted and participated in doing an activity and learning as shown in the table 4, investigations a question in lesson plans and table 5, observation class.

Table 4
Investigations a question in lesson plans

Types of questions	PST-A		PST-B	
	LS-1	LS-2	LS-1	LS-2
- Comparison question	√	√	√	√
- Cause and effect question	-	√	√	-
- Prediction question	√	√	√	√
- Exploratory question	-	√	√	√
- Design and make question	-	-	-	-

Note: LS-1: lesson plan-1, LS-2: lesson plan-2

Table 4 was the result of investigating the lesson plans of PST-A and PST-B teaching found that they used in various types of question, including; comparison question, cause and effect question, prediction question and exploratory question, to teach students in science class. For examples, "This image, which are fossil of a plant or fossil of an animal and how?" and "which the dinosaurs are big between the Phuwiangosaurus sirindhornae and this dinosaur in figure and why? These questions were a type of comparison question. The types of a cause and effect question and explore questions found that PST-A used these types of question in lesson plan-2 to ask students. For examples, "why are these animal extinction?" and "what are the characteristics of animals that can survive in various habitats? This question was types of a cause and effect question and exploration questions, respectively. For the result of PST-B used the question both of lesson plan-1 and 2 there were three types of question, including; comparison question, prediction question and explore question. For example, in comparison question, "when we use iodine solution to test starch, in leaves that receives light and does not receive light, what the results are the differences?" and "what a difference of a good quality water and low quality water?". Furthermore, in lesson plan-1, PST-B used type of a cause and effect question to ask their students. For example, "why we need to boil the leaves in alcohol before taking it to experiment?" In addition, the results of an observation classroom of PST-A and PST-B teaching were shown in table 5 and table 6, respectively.

Table 5
Observation classroom of PST-A teaching in science class

Lesson plan-1	Lesson plan-2
- The outcome of PST-A asked the question of comparison. For example, *"this image, which are fossil of a plant or fossil of an animal and how?"* This asking question prompts the students observe, discuss and brainstorm together in groups in order to compare the images of fossils and do classification kind of fossils. - The outcome of PST-A asked question of prediction was; *"have the students predict about the clue, what is a kind of animal sign that you saw?,* This question prompted the students observe and predict before they do the activity in a worksheed. Then, they present, what about they saw to classmate. This teaching activity prompts the students interacted and collaborated in making activity and participated in the learning.	- The outcome of PST-A asked the question of cause and effect. For example, *"why are these animal extinction?*", This question prompts the students discuss, analyse and brainstorm in within groups in order to find the cause of phenomena, which the students in groups interacted and collaborated in doing the activity. - The outcome of PST-A asked student in type of exploration question was*; "what are the characteristics of animals that can survive in various habitats?",* This question prompted the students observe and discuss to find the characteristics of animals that can survive in various habitats. After studied, the students presented to classmate.

Note: Lesson plan-1: Fossils topic, Lesson plan-2: Dinosaurs in Thailand and extinction of living thing topic

The result from table 5 found that pre-service teacher-A (PST-A) used in various types of question such as comparison question, prediction question, cause and effect question and exploration question but does not used question in type of design and make question. However, four types of question that PST-A used in asking students could provide students to discuss, observe, analyse a cause of dinosaurs' extinction. In addition, students could practice by themselves in doing an activity and present to classmate after PST-A asked the question. Furthermore, the teaching of PST-A used the four types of questions could the students interacted and collaborated in doing activity of study.

Table 6
Observation classroom of PST-B teaching in science class

Lesson plan-1	Lesson plan-2
- The outcome of PST-B asked the question of comparison. For example, *"when we use iodine solution to test starch, in leaves that receives light and does not receive light, what the results are the differences?",* this question prompted the students observe and do the experiment by themselves. The students have discussed and branstroming together in within groups when they did an experiment and after they finish did the experiment, they presented the outcome to classmate. - The outcome of PST-B asked question of a cause and effect. For example, "*why we need to boil the leaves in alcohol before taking it to experiment*?", This question prompted the students analyse a reason of boiling the leaves and they did an experiment. In addition, they interacted and collaborated in doing experiments in the group.	- The outcome of PST-B asked the question of comparison question. For example, *"what a difference of a good quality water and low quality water?",* this question prompts the students observe, discuss and brainstorm in groups to find the differences of the quality water. - The outcome of PST-B asked student in type of d exploration question was; *"how is the feature of color in the water that you see?",* Thus the question that PST-B given the students observe the color in the water prompted the students observe and discuss to find the feature of color in the water. Then, the students in each group did an activity sheet and presented to classmate.

Note: Lesson plan-1: Factors of photosynthesis (light and chlorophyll) topic,
Lesson plan-2: Factors of the qualitative of water topic

The result from table 6 found that pre-service teacher-B (PST-B) used in various types of question such as comparison question, prediction question, cause and effect question and exploration question, but does not used question in type of design and make question the same PST-A teaching. Four types of question that PST-B used in asking students could provide students to discuss, observe, analyse, and practice by themselves in doing experiments in within the group. After they finished doing experiments, they presented the outcomes to classmate. In addition, the teaching of PST-B used the four types of questions could the students interacted and collaborated in doing activity of study.

From the results of pre-service teachers, PST-A and PST-B, used, the types of question in their teaching shown that the each of the types of question provided the students to discuss and observe such as the types of comparison question, prediction question and exploration question. This type of question brings the students to do experiments in order to find the answer from asking questions. In addition, a cause and effect question was the question that provides the students to analyze a cause of phenomena. Furthermore, all of the types of question prompted the students interact and collaborate in doing experiments and learning in class. Consequently, the types of question that pre-service teachers used to ask the students in teaching and learning in science class were the questions that make the students learn with active learning as shown on characteristics of active learning in table 7.

Table 7
Results of teaching active learning

Characteristics of active learning	PST-A		PST-B	
	LS-1	LS-2	LS-1	LS-2
- Interaction and collaboration	√	√	√	√
- Practicing	√	√	√	√
- Analysis or creating thinking	√	√	√	√
- Observing	√	√	√	√
- Brainstorming	√	√	√	√
- Discussing	√	√	√	√
- Writing	√	√	√	√
- Presenting	√	√	√	√

Note: LS-1: lesson plan-1, LS-2: lesson plan-2

In addition, results of students' interview, they told that they have participated in doing the activity and together to work with friends in groups as the examples of students' interview as follows;

Student 1: *"We observed the figure of the fossils and compared the differences of two fossils, which PST-A given us discuss together before answering the question"*

Student 2: *"PST-A asked us about a cause of dinosaurs' extinction after we watched the video of dinosaurs, which we were asked in each group and explained to my friends in class"*

Student 3: "*PST-B asked us about the outcome of photosynthesis in leaf, then she let us did the experiment and present the outcome to my friends in class*"

Student 4: *"We observed the color of water and compared differences the color of water in each the bottle and after we observed the differences of water. then, PST-B given us present the quality of water in each the bottle and discuss together in the class"*

4. Conclusion

PST-A taught about fossils in lesson plan-1, and dinosaurs in Thailand and extinction of living thing in lesson plan-2. She used types of question to ask students in lesson plan-1 were; comparison and prediction question. In lesson plan-2, she used four types of question, including; comparison question, cause and effect question, prediction question and exploratory question. PST-B taught about factors of photosynthesis (light and chlorophyll) in lesson plan-1, which she used four types of question to ask students, including; comparison question, cause and effect question, prediction question and exploratory question. In lesson plan-2, she used three types of question, including; comparison question, prediction question and exploratory question. Each type of question prompted the students learn science through observing, discussing, practicing by doing experiments. Therefore, when students learn science, through asking questions, it prompted students have active learning in science class as follow;

- Type of comparison question prompted the students have active learning were; the students observed and discussed about two images of fossils to compare the difference. In addition, the students observed and did experiments to find the differences of the outcome after test leaves receives light and another one not by using iodine to compare the results.
- Type of cause and effect question prompted the students have active learning were; the students' analysis a causing of phenomena that occurring and discuss to find the relationship of causing was occurring. For example, "why are these animals extinction?, This question prompts the students analyse the cause of phenomena. Moreover, the students discussed and brainstorm to find a reason of the cause in phenomena.
- Type of prediction question prompted the students have active learning were; the students observed and predicted before they do experience or before they study. For examples, pre-service teacher have the students predict about the clue and asked students about the

question was; “what is a kind of animal sign that you saw?”, In which the students need to observe and then they did an experiment to find the correct answer.

- Type of exploration question prompted the students have active learning were; the students explored and observed something to discuss and present from exploring. For example, the students observed the feature of color in the water and then they did an experiment to explore something in the water.

In addition, when pre-service teachers used the questions in teaching science, it provided the students to interact and collaborate in doing the activity and learning.

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