Journal for the Education of Gifted Young Scientists, 8(2), 843-856, June 2020
e-ISSN: 2149- 360X
jegys.org

Young Wise Publishing
youngwisepub.com

Research Article

Question types of pre-service teachers at the implementation of a new learning model: a comparison between QASEE, RQA, and conventional learnings

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Article Info

Received: 11 November 2019
Revised: 25 May 2020
Accepted: 01 June 2020
Available online: 15 June 2020

Keywords:
Bloom taxonomy
Learning models
Pre-service teachers
Questioning skills
Teacher education

Abstract

This research aims at analyzing the question types posed by pre-service teachers at the implementation of QASEE (Questioning, Answering, Sharing, Extending and Evaluating) learning and its comparison with RQA (Reading, Questioning, and Answering) learning and conventional learning. 107 pre-service teachers participated in this qualitative and quantitative research. The data of questions raised during the learning activities were collected using observation sheets. The collected questions were analyzed related to the content and were classified based on the revised version of Bloom's taxonomy. The results were then analyzed descriptively. Based on the cognitive process dimensions, in the QASEE class, the most common question type found is the Q_2 questions (59.34%) and only few Q_1 questions (2.75%) are found; in the RQA class, the most common question type is the Q_2 questions (67.22%) and only a small number of Q_1 types (2.79%) are found, while in the conventional class, the Q_1 and Q_2 questions are found in the same frequency (32.35%). Based on the knowledge dimension, in the QASEE class, the most question type found is the Q_C questions (86.64%) and only few Q_F questions are found (1.75%); in the RQA class, the most question type found is the Q_C questions (83.94%) and only few Q_F questions (5.57%) are found, while in the conventional class, the frequencies of the Q_F and the Q_C questions are 32.35% and 44.12% respectively. Based on the cross-section dimension, in the QASEE class, the most question type found is the classify questions (57.60%) and only few list questions (0.42%) are found. In the RQA, the classify questions (63.40%) are also the most question type found and only few list questions (1.86%) were found, while in the conventional class, the most question type found are the list questions (32.35%), and the classify questions (32.35%). The QASEE learning has the most potential in encouraging pre-service teachers to produce better questions, because it has the highest frequency of HOT (Higher Order Thinking) and Q_M questions as well as the lowest frequency of list question, compared to the RQA and conventional learning.

To cite this article:
Saputri, W., & Corebima, A.D. (2020). Question types of pre-service teachers at the implementation of a new learning model: a comparison between QASEE, RQA, and conventional learnings. *Journal for the Education of Gifted Young Scientists, 8*(2), 843-856. DOI: http://dx.doi.org/10.17478/jegys.647916

Introduction

Global challenges require the education system in every country to produce an agent of change in the 21st century. This certainly creates a new paradigm in the world of education. The education today, including the higher education which prepares the pre-service teachers, is required to apply active learning, in which the pre-service teachers are involved in efforts to construct their own knowledge. One way to fulfil this demand is by developing the questioning skills (Almeida, 2012; de Boer et al. 2019).

It is important that the pre-service teachers have good questioning skills, because it can help them to understand texts better (Akkaya & Demirel, 2012). In fact, the activity of making questions after reading texts can increase understanding better than just answering or rereading texts (Bowker, 2010; Weinstein et al. 2010). In addition, questioning skills are the key to become self-direct learners (O'Holleran et al. 2019) and independent thinkers (Bowker,

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2010). This can also become the tools to empower metacognitive skills (Cerdán et al. 2019; Chin & Osborne, 2008). This will eventually have an effect on the improvement of the their academic performance and cognitive learning outcome (Shakurnia et al. 2018).

Related to their teaching career in the future, the questioning skills can be an assets in preparing learning plans (Purdum-Cassidy et al. 2015) as well as in developing meaningful learning and increasing learning motivation (Cardoso & Almeida, 2014; Chin & Osborne, 2008; Olde Bekkink et al. 2015), encouraging collaboration (Song et al. 2017) and scientific inquiry (Chin & Osborne, 2008). Even the ability to make questions, especially related to hypothetical high-order questions that encourage divergent thinking, is reported to be able to produce qualified arguments better than the ability to make basic question types (Phua & Tan, 2018). In addition, it is essential that the pre-service teachers master these questioning skills because it can indirectly affect the development of the questioning skills of their students in the future (Stokhof et al. 2016; Yeşil & Korkmaz, 2010).

The questioning skills of an individual can be assessed based on the types of questions that he or she poses. The question types in Bloom's taxonomy revised by Anderson and Krathwohl (2001) are classified based on cognitive process dimensions and knowledge dimensions, as well as cross-section dimensions of the cognitive process dimension and knowledge dimension. But unfortunately, based on the quality/types of questions, some researches report that most pre-service teachers have relatively low questioning skills. Research conducted on a number of teachers and students in science classes found that the quality of the questions posed by students was quite poor and the quantity was far fewer than that proposed by the teachers (Eshach et al. 2014). Likewise, Bay (2016) reported that the types of questions posed by pre-service teachers in Turkey and US were still categorized as LOT (Lower Order Thinking). The results of the research are not much different from those found in Indonesia. Amin et al. (2017) and Pramudiyanti et al. (2015) reported that the question types of more than 70% of pre-service teachers participating in the research were still in the LOT category.

This is thought to be related to the high dominance of lecturers in posing questions in class (Eshach et al. 2014; Yeşil & Korkmaz, 2010). Another possibility is that it is caused by the internal factors, including (a) they do not know what to ask because they cannot detect cognitive disequilibrium conditions, (b) they can detect cognitive disequilibrium conditions but they are not used to, dislike or lazy to ask, feel embarrassed, and also (c) they are unable to make the questions (Almeida & Neri de Souza, 2010). Therefore, a learning that is able to "force" every pre-service teacher in the class to make a question is necessary.

Related to this, a learning model that has been proven to be able to facilitate pre-service teachers to develop their questioning skills is RQA learning model. The RQA learning model consists of reading, questioning, and answering activities. These activities are intentionally designed to familiarize each pre-service teachers to individually read the learning material before attending the class, so that they are better prepared to follow the learning process (Corebima, 2016; Hariyadi et al. 2017). This preparedness is what encourages them to produce higher level question types than the pre-service teachers in the conventional learning (Hariyadi et al. 2017). However, recent research conducted by Kaya & Temiz (2018) reported that questioning skills could also be improved by introducing them to taxonomy questions and learning in groups.

In this regard, a new learning model is believed to be adequately potential to hone the questioning skills of pre-service teachers. This learning model is QASEE. The QASEE learning model was initially developed by researchers to improve pre-service teachers' metacognitive skills, keterampilan berpikir kritis (critical thinking skills), cognitive learning outcomes, and retention. It was developed by referring to three previous learning models that had been proven to be able to improve the three competencies, namely RQA, TPS, and PBL. Based on the results of the analysis of the syntax of the three learning models, the syntax of QASEE learning model consisting of Questioning, Answering, Sharing, Extending, and Evaluating activities was developed. This will be described as follows.

First, pre-service teachers are encouraged to prepare initial knowledge by creating questions and answers individually. Questioning and answering activity which is adopted from the RQA learning model are believed could facilitate the development of questioning skills (Hariyadi et al. 2017). Then, unlike the RQA learning model, the QASEE learning model includes a sharing activity that promotes pre-service teachers in groups to discuss questions and answers that have been individually made before these questions and answer are presented in front of the class. This activity is believed to be able to be used as a means to hone the questioning skills as well as to increase the quality of questions (Kaya & Temiz, 2018; Singh et al. 2019). The knowledge obtained from the three previous activities is then applied to a new context (extending). Extending activity is also believed to indirectly improve and strengthen pre-service teachers' comprehension, so that the questions raised in the next learning activity will be of higher quality.

Finally, evaluation or reflection is carried out on the learning activities that have been done (evaluating). the evaluating activity that facilitates the development of metacognition (Duman & Semerci, 2019; Zhang & Patrick, 2012), is confirmed to be identical with evaluative questions as stated by Chin & Brown (2002). The research results by Saputri et al. (2020) show that the QASEE learning model developed successfully increases the critical thinking skills of different academic ability pre-service teachers. In fact, the corrected mean score of critical thinking skills of the lower academic ability pre-service teachers in the QASEE class is higher than that of the lower academic ability pre-service teachers in the RQA class. In this connection, since one of the supporting factors of the improvement of critical thinking skills is good questioning skills (Bezanilla et al. 2019), the QASEE learning model is believed to be potential in improving the questioning skills, perhaps even more potential than is the RQA learning model. However, the strength of the QASEE learning model has not been proven in encouraging pre-service teachers to create better questions

Research Questions

Based on the description above, it was considered necessary to do an analysis of the types of questions that the pre-service teacher created at the implementation of QASEE learning model, as well as its comparison with the implementation of RQA learning model and conventional learning. Therefore, the research questions for this study were:

- Based on the cognitive process dimension, what types of questions are found in the classes taught by using the QASEE and RQA learning models, as well as conventional learning?
- Based on the knowledge dimension, what types of questions are found in the classes taught by using the QASEE and RQA learning models, as well as conventional learning?
- Based on the cross-section dimensions between the cognitive process dimension and the knowledge dimension, what types of questions are found in the classes taught by using the QASEE and RQA learning models, as well as conventional learning?

The results of this research are expected to be useful as a reference for lecturers on how to develop pre-service teacher' questioning skills, especially regarding with high-level questions.

Methodology

Research Design

This research used qualitative and quantitative approaches. Research supported by a qualitative approach is carried out to explore and understand the phenomenon of the observed object. While the research supported by quantitative approach is carried out to analyze trends, to compare groups, as well as to find out the correlation between variables using certain statistical analyses (Creswell, 2012).

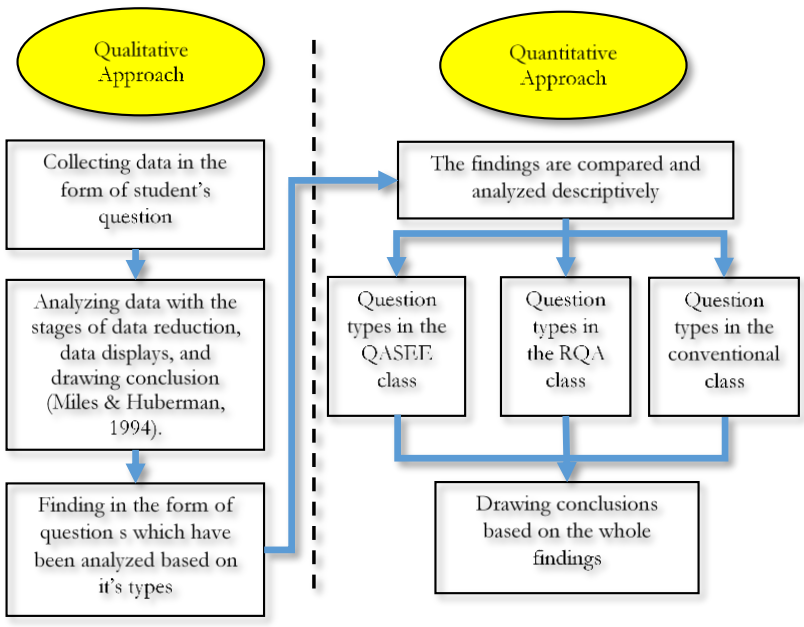

Figure 1.
Research Design

In this research, a qualitative approach is used to collect and analyze the types of questions asked by pre-service teachers during the learning process. While the quantitative approach is used to compare the types of questions found in each class implementing different learning models. Both approaches are used to achieve the research objectives, namely to analyze and compare the types of questions made by pre-service teachers during the implementation of QASEE and RQA learning models, as well as of conventional learning. The research model is displayed on Figure 1.

Participants

The research was conducted at the Biology Education Study Program at Universitas Islam Negeri Raden Fatah, Palembang, Indonesia. The research subjects were the VI semester pre-service teachers who programed Animal Ecology course in the 2017/2018 academic year with a total number of 107 pre-service teachers. These pre-service teachers were divided into three classes. An equality test was done to each of the class using the placement test items, and the results of the equality test showed that the classes were equal and feasible to be included in the research.

Table 1.

Structures of Participants

Variables	Categories	f	%
Gender			
	Male	97	90,65
	Female	10	9,43
		107	

The data in Table 1 show that the number of female pre-service teachers (90,65%) participating in this research is bigger than that of the male pre-service teachers (9,34%). Because of this striking percentage difference, this research does not separate the analysis process based on the types of questions between male and female pre-service teachers.

Data Collection

The data collected in this research are in the form of questions raised by the pre-service teachers during the learning process. While the instruments used to collect these questions are observation sheets and lecturer's notes. In addition, for the QASEE and RQA classes, the questions were also collected from the pre-service teacher worksheets that had been validated by learning experts. The results of the validation declared that the pre-service teacher worksheets were valid for use. The data were collected from various sources in order to ensure the validity of the data (Creswell, 2009).

The data collection process was carried out in the Animal Ecology course within 1 semester (February- May 2018). The procedures of data collection began with introducing the pre-service teachers to the types of questions based on the revised version of Bloom's taxonomy. Then, the pre-service teachers in each class were taught by using different learnings, namely the QASEE learning model (experimental class), RQA learning model (positive control class), and conventional learning (negative control class).

The next step was to detect different opinions through articles and published literature, which dealt with the topic. Afterward, it was necessary to explain the interior design program, valid teaching criteria for the student, and the most prestigious courses of the program. This analysis aims to explore the weaknesses of several physiological aspects to stimulate and develop the learning process in the interior design student. Characterization of perception is one of the most critical mental and physiological skills that must be available for the student to learn any design program. The learning activities in the QASEE class:

- Phase 1 - Questioning: pre-service teachers make a number of questions independently
- Phase 2 - Answering: pre-service teachers independently answer the questions that they already made
- Phase 3 - Sharing: pre-service teachers discuss the questions and answers that have been made with their group members and present the results of the discussion in front of the class.
- Phase 4 - Extending: pre-service teachers in groups are asked to apply their knowledge in a new context
- Phase 5 - Evaluating: pre-service teachers carry out self-evaluation on their whole learning process.

The learning activities in the RQA class:

- Phase 1 - Reading: pre-service teachers read and make a summary of the learning material
- Phase 2 - Questioning: pre-service teachers make a number of questions independently
- Phase 3 - Answering: pre-service teachers independently answer the questions that they already made and present the results in front of the class.

In the conventional class, the learning activities include discussion, questions and answers, as well as lectures. All of the questions that raised by pre-service teachers for one whole semester of learning are recorded for further analysis.

Data Analysis

The qualitative data analysis in this research referred to the data analysis process by Miles, Huberman, & Saldaña (1992) consisting of data reduction, data presentation, and making conclusions. The process of data reduction was done by sharpening, classifying, directing, selecting, and eliminating any unwanted data. In addition, the data presentation was done by arranging and organizing the data in such a way that it helps the process of making conclusions.

The data in this research were in the form of questions, which were analyzed for the content. The types of the questions were classified based on the revised version of Bloom's taxonomy by Anderson and Krathwohl (2001) which consisted of cognitive process dimension and knowledge dimension, as well as cross section dimension between the cognitive process dimension and the knowledge dimension. The cognitive process dimension consisted of LOT question types (Lower Order Thinking): remember (Q_1), understand (Q_2), apply (Q_3), and HOT question types (Higher Order Thinking): analyze (Q_4), evaluate (Q_5), create (Q_6). Then, the factual dimension included: factual (Q_F), conceptual (Q_C), procedural (Q_P), and mecatognitive (Q_M) question types. While the cross section dimension consisted of the interaction between the question types of cognitive process dimension and the question types of knowledge dimension.

Related to the aspect of reliability, the data analysis process involves not only the main researcher but also an expert lecturer who was considered competent in this field. The use of two raters is intended to ensure the consistency in the assessment of the question types of the pre-service teachers. After coded, the data are analyzed using Kappa approach with the assistance of SPSS software. If the coefficient value of the Cohens's Kappa is above 0.75, the agreement of the raters is the very good category (Fleiss et al. 2003). The results of the analysis show that the coefficient value of Cohen's Kappa is 0.989 (cognitive dimension), 0.971 (knowledge dimension), and (0.990) (cross-section dimensions). Thus, it can be concluded that the two rater have a very good agreement in assessing the questoin types of the pre-service teachers.

Then, the data were presented in tables and descriptively analyzed, by calculating the percentage of the types of questions found. Then, the percentages of the types of questions that appear both in the cognitive process dimension, the knowledge dimension, and the cross section dimension in each classes were compared. Thus, the information on the types of questions that arised after the pre-service teachers had been taught by using the QASEE, RQA, and conventional learnings could be obtained. In Table 2 there are some examples of question types that have been created by pre-service teachers.

Table 2.

Examples of Pre-service Teachers' Questions

No	Questions	Cognitive Type	Knowledge Type	Type of cross-section dimensions
1	What animals are catagorized as keystone species?	Q1	QF	List
2	How do land animals adapt to changing environmental temperatures?	Q2	QC	Classify
3	How do we measure the density of soil insects?	Q3	QP	Provide
4	Why is using parasitoid insects considered more effective in helping farmers to eradicate pests than using insecticides?	Q4	QC	Differentiate
5	Why do humans need to study animal behavior? What are the benefits for humans?	Q5	QM	Reflect
6	If you are a zoo owner, what kinds of animal will be used as a collection and how will you provide a comfortable habitat for the animals?	Q6	QC	Assemble

Results and Discussion

Results Related to Sub-problem 1: Types of Questions Based on Cognitive Process Dimension

The types of questions based on the cognitive process dimension in the classes taught by using QASEE and RQA learning models, as well as conventional learning are analyzed. The results of the analysis and its comparison are presented in Table 3.

Table 3 shows that the most commonly found question type in the QASEE class is the Q2 questions, with percentages of 59.43% and the least found question types are the Q1 (2.75%) and Q6 (0.17%). Then, the most commonly found question type in the RQA is the Q2 questions, with percentages of 67.22% and the least found question types are the Q1 (2.79%) and Q6 (0.37%). Meanwhile, the most commonly found question types in the conventional class are the Q1 and Q2 questions with the same percentage, namely 32.35%; the least found question types are the Q5 (2.94%), and Q6 (0.00%) questions.

Table 3.

Comparison of Question Types Based on Cognitive Process Dimension in Classes Taught by Using QASEE and RQA Learning Models, as well as Conventional Learning

Code	Question Types	QASEE (%)	Order of Thinking (%)	RQA (%)	Order of Thinking (%)	Conventional (%)	Order of Thinking (%)
Q_1	Remember	2.75	79.05 (LOT)	2.79	86.54 (LOT)	32.35	70.58 (LOT)
Q_2	Understand	59.43		67.22		32.35	
Q_3	Apply	16.86		16.53		5.88	
Q_4	Analyze	13.44	20.70 (HOT)	8.17	13.00 (HOT)	8.82	11.76 (HOT)
Q_5	Evaluate	7.10		4.46		2.94	
Q_6	Create	0.17		0.37		0.00	
	Out of topic	0.25	0.25	0.46	2.27	17.65	17.65

Based on Table 3, it can also be seen that generally the QASEE, RQA, and conventional classes are dominated by LOT question types. However, the highest number of HOT questions is found in the QASEE class (20.70%), followed by those found in the RQA class (13.00%), as well as those found in the conventional class (11.76%). Moreover, what needs to be highlighted is that in the conventional class, the highest percentage of out of topic questions is found (17.65%), and in fact the frequency is bigger than that of the HOT question types in the conventional class.

Results Related to Sub-problem 2: Types of Questions Based on Knowledge Dimension

The types of questions based on the knowledge dimension in the QASEE, RQA, and conventional classes are analyzed. The results of the analysis are presented in Table 4. Table 4 shows that the most commonly found question type in the QASEE class is the Q_C question (86.64%) and the lowest question type is the Q_F question (1.75%). Then, in the RQA class the most commonly found question type is the Q_C question (83.94%) and only few Q_F question (5.57%). Meanwhile, in the conventional class the most commonly found question type is the Q_C question (44.12%) and the lowest question types are the Q_P question (2.94%) and Q_M question (2.94%).

Interestingly, the Q_M question type as the highest level in the knowledge dimension is the most found one in the QASEE class (6,51%) as well as in the RQA class (5,76%). On the contrary, the Q_F question type, as the lowest level in the knowledge dimension, is the most found one in the conventional class (32.35%), even the frequency is about 18 times greater than that of the Q_F question type in the QASEE class, and 5 times greater than that of the Q_F question type in the RQA class.

Table 4.

Comparison of the Question Types Based on Knowledge Dimensions in the Classes Taught by Using QASEE and RQA Learning Models, as well as Conventional Learning

Code	Question Types	Class		
		QASEE (%)	RQA (%)	Conventional (%)
Q_F	Factual	1.75	5.57	32.35
Q_C	Conceptual	86.64	83.94	44.12
Q_P	Procedural	4.84	4.27	2.94
Q_M	Metacognitive	6.51	5.76	2.94
	Out of topic	0.25	0.46	17.65

Results Related to Sub-problem 3: Types of Questions Based on Cross-section of Cognitive Process Dimension and Knowledge Dimension

The types of questions based on cross section of cognitive process dimension and knowledge dimension in the classes taught using QASEE and RQA learning models, as well as conventional learning are analyzed. The results of the analysis are presented in Table 5.

Based on the data of cross dimension between the cognitive process dimension and the knowledge dimension in Table 5, it can be seen that the QASEE class is dominated by the classify question type (57.60%), and the lowest percentages of the question type are the question type of list, clarify, predict, respond, integrate, generate and assemble. Then, the RQA class is also dominated by the classify question type (63.40%), and the lowest percentage question types are the question types of list, clarify, predict, respond, generate, and assemble. Meanwhile, the conventional class is dominated by the list question type (32.35%) and the classify question type (32.35%), and the lowest percentages are the question type of provide, carry out, and reflect. Interestingly, even though the question type generate and assemble, as the highest level of question types in the cross section dimension, are found in a low percentage in the QASEE and RQA classes; this type of questions are not found at all the conventional class.

Table 5.

Comparison of Question Types Based on Cross-section Dimension

Code	Q_F	Q_C	Q_P	Q_M	Class
Q_1	0.42	2.34	-	-	QASEE
	1.86	0.93	-	-	RQA
	32.35	-	-	-	Conventional
	List	Recognize	Recall	Identify	
Q_2	1.09	57.60	0.05	0.25	QASEE
	3.34	63.40	0.09	0.46	RQA
	-	32.35		-	Conventional
	Summarize	Classify	Clarify	Predict	
Q_3	0.17	13.30	3.42	-	QASEE
	0.37	13.00	3.25	-	RQA
	-	2.94	2.94	-	Conventional
	Respond	Provide	Carry out	Use	
Q_4	-	11.40	0.25	1.75	QASEE
	-	6.13	-	2.04	RQA
	-	8.23	-	-	Conventional
	Select	Differentiate	Integrate	Deconstruct	
Q_5	-	2.76	-	4.42	QASEE
	-	1.02	-	3.25	RQA
	-	-	-	2.94	Conventional
	Check	Determine	Judge	Reflect	
Q_6	0.08	0.08	-	-	QASEE
	0.19	0.19	-	-	RQA
	-	-	-	-	Conventional
	Generate	Assemble	Design	Create	

Discussion and Conclusion

As mentioned earlier, questions are the key to begin a learning process (Almeida, 2012). This is because questions are the reflection of an individual's thinking process (Dewey, 1933). The higher the level of questions raised by the students, the higher the level of their thinking process, and vice versa (Chin & Osborne, 2008). In this research, the levels of the students' questions and thinking are determined by referring to the revised version of Bloom's Taxonomy (Anderson & Krathwohl, 2001), which is divided into three dimensions as discussed below.

Question Types Based on Cognitive Process Dimension

The cognitive process dimension itself is related to six levels of thinking processes, namely remembering, understanding, applying, analyzing, evaluating, and creating (Anderson & Krathwohl, 2001). When it is related to the levels of questions, the lowest level of question types is the remembering question (Q1), and the highest level of the question types is the creating question (Q6). The high or low levels of the questions that the students raised are related to the capacity of knowledge they possessed. As mentioned by Miyake & Norman (1979), to be able to ask a question, a person must have sufficient knowledge about what he or she does not know.

In this research, based on the cognitive process dimension, the most common type of question made by the pre-service teachers taught by using QASEE learning model is the question type of Q_2 (understand). This means that the students taught by using the QASEE learning model have sufficient knowledge to connect their initial knowledge and the new knowledge they acquire. Therefore, the questions found tend to address students' understanding, such as interpreting, classifying, and explaining. While the basic question types, which are intended only for recalling and recognizing (Q_1), is very rarely found.

This fact is in line with the research results of Hariyadi et al. (2017), Kaya & Temiz (2018), and Yeşil & Korkmaz (2010) who reporting that the application of question-based learning models had an effect on the quality of questions. The questioning activity in the QASEE learning model forces the pre-service teachers to read the learning material in advance before they attend the class, so that they have the prior knowledge of the learning material. In this case, the prior knowledge plays an important role as a foothold in making questions (Chin & Brown, 2002; Hariyadi et al. 2017).

Interestingly, even though only few question type of Q_6 is found, the HOT question type found in the QASEE class is much more than that found in the RQA and conventional classes. This is in line with Blonder, Rap, Mamlok-Naaman, & Hofstein (2015) who reported that more HOT questions were found in the learning which directed students to construct their knowledge through inquiry activities than those in the traditional learning. Such learning experience is what is found in the class taught by using the QASEE learning model. Questioning and answering activity in the QASEE learning model are reported to be able to encourage the pre-service teachers to ask higher level questions better than just answering questions from the lecturers or even after the implementation of blended learning model (Yeşil & Korkmaz, 2010). Likewise in the sharing activity, it is mentioned that the dialogue within the group (sharing) could encourage pre-service teachers to produce better questions (Bielik & Yarden, 2016; Kaya & Temiz, 2018) and increase their comprehension (Kaya & Temiz, 2018; Muhlisin, 2019; Olde Bekkink et al. 2015). This condition certainly has an effect on the class discussion activities later, where the pre-service teachers are welcome to ask questions verbally over the learning material presented by other groups. Meanwhile in the extending activity, although it does not have a direct role, it is believed to be quite effective to strengthen the understanding of the learning material because it facilitates the application of concepts that have been obtained into a new context (Wisetsat & Nuangchalerm, 2019). This understanding is important for understanding the learning material in the next meeting, so that the questions raised become more qualified. Finally, evaluating activity through posing questions to oneself and related to the content of the learning material familiarizes the pre-service teachers to make evaluative questions (Chin & Brown, 2002; Dang et al. 2018). Therefore, it is normal to find many types of questions that require a high level of thinking in the QASEE class.

Similar to the QASEE class, most of the questions asked by the the pre-service teachers taught by using the RQA learning model are the question type Q_2. This is in line with the findings of previous researches reporting that the question types which were dominant in the RQA class were the question types Q1, Q3, Q4, Q5, and Q6). They stated that such conditions were influenced by the reading activites followed by summarizing text activities making the pre-service teachers had sufficient knowledge before the class begins. As a result, the questions made tend to construct meaning or concept of the material learned (Hariyadi et al. 2017).

Then, only a few pre-service teachers in the RQA class posed question type Q6. However, the percentage of the HOT question types were far more than those proposed by the pre-service teachers in the conventional class. As previously mentioned, the reading activity produces good initial understanding, so that it has a positive effect on the

types of questions produced by the pre-service teachers (Hariyadi et al. 2017). Likewise, the questioning activity was also proven to increase not only the quantity of the questions but also the quality of the questions asked (Hariyadi et al., 2017; Kaya & Temiz, 2018; Yeşil & Korkmaz, 2010). Of course, the pre-service teachers in the RQA class and in the QASEE class have been initially provided with the knowledge on how to arrange questions in accordance with the revised version of Bloom Taxonomy. This has also been proven to be effective in guiding the process of making questions better (Kaya & Temiz, 2018; Teplitski et al. 2018).

Meanwhile, the pre-service teachers taught by using the conventional learning tended to propose question types Q_1 and Q_2. As a result, few types of HOT questions were found. The absence of activities that 'intentionally' require the pre-service teachers to make questions or other activities that have the potential to improve the quality of questions is believed to be the cause. As a result, the pre-service teachers in the conventional class were not trained to make questions, especially high-level questions. In fact, it was also found that quite a number of questions were not suitable with the topic of the discussion which were only proposed to seek scores. This finding is in line with the results of the previous research, which reported that the conventional class was dominated with LOT question types (Hariyadi et al. 2017; Kaya & Temiz, 2018; Yeşil & Korkmaz, 2010), and the pre-service teachers tended to be less capable of making HOT question types, especially Q_5 (evaluate) and Q_6 (create) (Hariyadi et al. 2017).

Types of Questions Based on Knowledge Dimensions

The knowledge dimension, according to Anderson & Krathwohl (2001), relates to the type of knowledge possessed by individuals, namely factual knowledge, conceptual knowledge, procedural knowledge, and metacognitive knowledge. When it is related to the levels of questions, the factual question type (Q_F) is the lowest level, and the metacognitive question type (Q_M) is the highest level.

The results of this research show that based on the knowledge dimension, the most commonly found question type in the QASEE and RQA classes is the Q_C (conceptual question type). This finding is believed to be related to the findings in the cognitive process dimension which is dominated by the question type Q_2. This fact is in line with Hariyadi et al. (2017) and Munzenmaier & Rubin (2013) stating that there was a correlation between the question type of Q_2 and Q_C. The question type of Q_C which includes classification, categories, models, theory, schemes, and concept interrelation is indirectly related to the question type of Q_2 which indicates an in-depth understanding of a concept. This is confirmed by Anderson & Krathwohl (2001) who suggested that conceptual knowledge is the basis of the formation of understanding.

The large number of the conceptual question types found is thought to have a relationship with the students who already had sufficient knowledge about classification and categories, principles and generalizations, as well as theories, structures and models. Miyake & Norman (1979) and Chin & Brown (2002) stated that capacity of knowledge will significantly determine the questions raised; while the knowledge capacity itself was influenced by the learning experience provided by the lecturers. The role of the QASEE and RQA learning models is crucial in this regard. As mentioned earlier, the activities in both learning models make the pre-service teachers more ready to take part in learning. Therefore, it is normal that pre-service teachers make more questions aiming at knowing the interrelationships between elements rather than just getting knowledge related to terminology and specific details and certain elements (question type Q_F).

However, interestingly the pre-service teachers in the QASEE class also ask the highest question type on the knowledge dimension, namely Q_M (metacognitive) question, more than those in the RQA class and the conventional class. Hariyadi et al. (2017) and Kaberman & Dori (2009) stated that there was a correlation between activation of metacognition and the posing of question type of Q_M. Metacognition is the basis of various types of self-instructions and self-control, such as communication, memory (Flavell, 1979), and comprehension (Flavell, 1979; Lestari et al. 2019). While the creation of question type of Q_M itself requires the mastery of cognitive knowledge in general and the awareness of cognitive knowledge of oneself (Anderson & Krathwohl, 2001). The empowerment of metacognition is what is facilitated by the syntax of the QASEE learning model, so that there are a lot of Q_M question types found.

The questioning activity at the QASEE learning model is reported to be capable of directing the pre-service teachers to activate their metacognition, namely thinking about the extent of their own comprehension (Chin & Osborne, 2008; García et al. 2014). The Answering activity is also a critical process that requires the selection of appropriate metacognitive strategies in order to obtain more comprehensive answers (Cerdán et al. 2019; Kaberman & Dori, 2009). Moreover, the sharing activity, in which there are communication and reflection activities on self and others' cognition, is also proven to be able to enrich and renew metacognitive knowledge (Efklides, 2008) and metacognitive skills (Chin & Osborne, 2008). Furthermore, the extending activity, where there is a transfer of

knowledge owned into a new context, also requires the involvement of metacognitive activities, such as planning, monitoring, and evaluating (Ramocki, 2007). Finally, the evaluating activity which is packaged in the form of self-reflection on learning experiences is reported as an important component in encouraging the improvement of metacognition (Dang et al. 2018; Duman & Semerci, 2019; Zhang & Patrick, 2012). Therefore, it is normal that many reflective Q_M questions are found in the QASEE class because its syntax is built on the elements of metacognition.

Not much different from the QASEE, the syntax of the RQA learning model also contains a component of metacognition. The reading activity in the RQA learning model involves complex thinking processes and metacognitive strategies to understand and summarize reading passages (Bahri & Corebima, 2015). Then, the questioning activity which involves the ability of monitoring and evaluating comprehension helps to activate metacognition (Chin & Osborne, 2008). Moreover, the answering activity involves the process of finding information and selecting metacognitive strategies to achieve goals and to obtain the right answers (Cerdán et al. 2019). As a result, the pre-service teachers taught by using RQA learning model also proposed the question type of Q_M more than those taught by using conventional learning (Hariyadi et al. 2017).

Meanwhile, the most types of questions made by the pre-service teachers taught by using conventional learning are question type Q_C and Q_F and they appear to have some difficulties to make question type Q_M. This is because the conventional class does not have any activities that help to develop the awareness of self-cognition. Discussion, presentation and lecture activities (Hariyadi et al. 2017; Muhlisin, 2019) as well as the learning dominated by teacher question (Yeşil & Korkmaz, 2010) are claimed to be unable to encourage pre-service teachers to ask questions, as well as to ask quality questions. In the conventional class, the questioning activity is also still considered as a complement, not as a trigger for the learning process. As a matter of fact, an activity is said to be a learning process if the pre-service teachers ask questions (Almeida, 2010; Almeida & Neri de Souza, 2010; Almeida, 2012).

Types of Questions Based on Cross Section of Cognitive Process Dimension and Knowledge Dimension

Cross section dimension is the results of the interaction between the cognitive process dimension and the knowledge dimension. The types of the questions generated are also the results of the interaction between the two dimensions. In the cross section dimension, the lowest level type of questions is the listing question, and the highest level type of questions is the creating question (Anderson & Krathwohl, 2001).

The results of this research show that both the QASEE class and the RQA class are dominated by the question type of classify, which is the result of the interaction between cognitive process dimensions, namely the understand level (Q_2) and the knowledge dimension, namely the conceptual level (Q_C). This occurs because both the QASEE and RQA learning models provide the opportunity for the pre-service teachers to construct meaning over the concepts of the learning material through the syntax of each learning model, especially related to the questioning syntax. The activity of creating questions is reported to be very important to be done when the pre-service teachers finish reading a text (Akkaya & Demirel, 2012) rather than re-reading the text or answering the already provided questions (Weinstein et al. 2010). Thus, it is normal that quite a number of question type of classify are found in both classes. Because the condition of the emergence of the question type of classify is a good concept understanding, so that the pre-service teachers can classify things according to certain categories (Anderson & Krathwohl, 2001). This is certainly good for avoiding misconceptions about the material learned (Hariyadi et al. 2017).

However, unfortunately the pre-service teachers in both the QASEE and RQA classes appear to have difficulty of making question types of generate and assemble which are the results of cross section dimensions between the cognitive process dimension of create level (Q_6) and the knowledge dimension of factual level (Q_F) and conceptual level (Q_C). This phenomenon possibly occurs because the pre-service teachers are not accustomed to making higher level types of questions. This is in line with the research results by Rahayu (2018) reporting that cognitive abilities in the cross section dimension between cognitive process dimension (Q_1, Q_2, Q_3, Q_4, Q_5, and Q_6) and the knowledge dimension (Q_M) are still relatively low to very low. In addition, it may also be related to the fact that some pre-service teacher do not enjoy the activity of making questions conducted throughout the semester because it add more works for them (Shakurnia et al. 2018).

Then, the process of asking questions also requires the students to be able to detect a condition which Jean Piaget calls as cognitive disequilibrium. This condition then requires the individuals to develop new schemes or to modify the existing schemes in order to make the condition balance (Plensdorf, 2011). Failure to detect this condition can cause the inability to ask questions. On the other hand, the process of asking questions also often encounters obstacles, related to the articulation of disequilibrium (verbal coding) and initiatives to express questions in a social environment (social editing) (Graesser & McMahen, 1993). Verbal coding obstacles can be in the form of pronunciation or word-

order obstacles in making questions. Meanwhile, the obstacles related to social editing can be in the form of shyness which discourage the students to ask questions (Graesser & McMahen, 1993). Therefore, it is necessary to make the pre-service teacher habituated to the practice of making questions, self-reflection, and giving feedback on the types of questions made so that them become more skilled in asking questions (Zhang & Patrick, 2012).

Unlike the QASEE class and the RQA class where the question type of list is very few, in the conventional class, a large number of question type of list is found along with the question type of classify. On the other hand, the question type of generate and assemble do not appear during the implementation of conventional learning. This is similar to what has been explained that in the conventional class the pre-service teachers attend the class without good initial knowledge about the learning material to be discussed. As a result, the questions asked tend to only confirm the concepts that had been known (Hariyadi et al. 2017). Even lecturers need more efforts to force pre-service teachers to ask. If nothing is done to this matter, in the future the pre-service teachers may lack the skills to develop active and meaningful learning and could not develop their students' questioning skills (Stokhof et al. 2016; Yeşil & Korkmaz, 2010). Therefore, strong support and commitment from lecturers and the pre-service teachers themselves are required in order to improve their quality, especially in making effective questions (Stokhof et al. 2016).

Based on the results of this research, it can be concluded that the implementation of learning model has a positive effect on the types of questions asked by pre-service teachers. On the cognitive process dimension, the QASEE and RQA classes are dominated by the question type of Q_2 and only few Q1 questions are found; while the conventional class is dominated by the question types of Q_1 and Q_2 with the same percentage. Then, on the knowledge dimension, the QASEE and RQA classes are dominated by the question type of Q_C and only few Q_F questions are found; while the conventional class is dominated by the question types of Q_C and Q_F. On the cross section dimension, the QASEE and RQA classes are dominated by the question type of classify and only the list questions are found; while the conventional class is dominated by the question type of classify and list with quite similar percentages.

However, in general the QASEE learning model shows higher potential than the RQA model and conventional learning. This is because in the QASEE class, based on thinking level of cognitive dimension, HOT question types are the most found; based on the knowledge dimension, the question type of Q_M is the most found; and based on the cross section dimension, the question type of list is the fewest found. Nevertheless, RQA learning model can still be used as an alternative learning model which can facilitate the development of the questioning skills of pre-service teachers.

Recommendations

QASEE and RQA learning models are recommended to be induced into the education program of pre-service teachers to train their questioning skills and to encourage their higher order thinking. Thus, qualified learning as the learning demand in the 21st century can be realized.

Acknowledgments

The authors thank to the Endowment Fund for Education (LPDP) Ministry of Finance Republic Indonesia that has funded the implementation of this research.

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