IOP Conf. Series: Journal of Physics: Conf. Series **1470** (2020) 012091 doi:10.1088/1742-6596/1470/1/012091

Teacher's questions on mathematics learning based on ELPSA framework

Rozalia[1], R Johar[1], M Duskri[2], C Khairunnisak[1] and T Zubaidah[1]

[1]Universitas Syiah Kuala, Jl. Teuku Nyak Arief, Darussalam, Banda Aceh 23111, Indonesia
[2]Universitas Islam Negeri Ar-Raniry, Jl. Syeikh Abdul Rauf, Darussalam, Banda Aceh 23111, Indonesia

Email: cut.khairunnisak@unsyiah.ac.id

Abstract. Teacher's question to encourage students to build their understanding is an essential aspect of mathematics learning. However, teachers show little concern about the quality of questions posed to students. Teachers can implement various strategies in conducting their roles as facilitators in developing students' understanding. One of which is through questions. ELPSA framework requires teachers to ask questions to help students construct their knowledge. This framework consists of five components: Experience, Language, Pictorial, Symbol, and Application. This study discussed the profile of teacher' questions based on ELPSA framework. The questions were classified into the types of questions, namely: factual, convergent, divergent, and evaluative questions. This study employed a qualitative research design using an observation sheet as the instrument. The participant of the study was a mathematics teacher from one of the junior high schools in Banda Aceh. The results concluded that the profile of teacher's questions in Year 8 of one of the junior high schools in Banda Aceh developed for each component of ELPSA framework. These developments were indicated by the suitability of the types of teacher's questions and the types of questions expected in the components of ELPSA framework.

Keywords: Teacher questions, ELPSA framework.

1. Introduction

Question is an essential aspect of mathematics learning. Amien [1] argued that the key to the inquiry process is posing significant questions to students. Teachers should be able to pose distinctive questions to promote students' thinking and inspire students to develop their understanding. Questioning itself is an effective skill to stimulate students' interaction, thinking, and learning [2]. Teachers' questions act as a means to deliver information for students. Therefore, the utilization of teachers' appropriate questions to let students develop critical thinking, strengthen understanding, correct misunderstandings, and provide feedback. Teachers' questioning techniques affect students' learning achievement and thinking. Teachers without the skills to pose questions will tend not to ask questions during the teaching activity; it will also be challenging for them to direct the learning process [3].

Higher-order questions should be posed in the learning process to improve students' critical thinking skills [4]. However, it appears that the teacher has asked many questions, but students answer together simultaneously [5]. Teachers mostly pose closed-ended questions requiring a short answer

during the learning, and students sometimes answer the questions simultaneously. Thus, it is difficult to identify which students give the correct answer. The teacher only gives good responses without following up on the answers to the questions.

Questions asked by the teacher should help and construct students' understanding in exploring the subject matter comprehensively, generate discussion and interaction among the students [6]. Through the questions posed by the teacher, it is expected that students not only extract factual information but also connect concepts and draw conclusions. Teacher questions can also increase awareness and encourage students' minds to be creative and imaginative [7]. Besides, teacher questions help students in critical thinking processes and explore understanding to a higher level [8]. Thus, the questions posed by the teacher can improve high-level learning by requiring students to analyze information, connect different concepts, and articulate their thoughts. The types of questions that can enhance the students' critical thinking process are those that improve responses in knowledge, understanding, analysis, synthesis, and evaluation.

The teacher's strategy in building students' understanding through these questions can be done through various approaches or learning models. The suitable approach or learning model is the one that provides opportunities for students to explore their understanding. One learning approach that supports teachers in asking the proper questions is learning based on ELPSA framework. The ELPSA framework was developed based on constructivism and social nature [9]. ELPSA framework is one of the learning frameworks that support the purpose of mathematics learning. This framework is expected to help teachers focus on the essential elements of learning. It also aims to enable students to learn mathematics actively, interpret mathematics, and apply mathematical knowledge in solving more complex problems. Therefore, a teacher that poses questions based on the ELPSA framework can encourage students to build their understanding.

ELPSA framework has five components, namely Experience, Language, Pictorial, Symbol, and Application. In the Experience (E) component, the teacher associates students' real-life experiences with mathematical ideas to be taught. This is important so that learning is meaningful for students. If students learn mathematics without associating it to their daily experiences, they will not be able to retain their understanding nor apply it in everyday life [10]. The teacher's effort to link the students' experience with new material can be made through questions. The questions should be posed are questions that explore students' experiences in accordance with the material to be studied, and questions that recall the topics that have been learned.

The use of language in the Language (L) component aims to develop the students' understanding because the mathematical thinking requires proper verbal expression. Language is an essential element in every learning. During the learning activities, students can use their language to express opinions related to the material studied. Thus, students will find it easier to construct their understanding. Constructing students' understanding using their language can be done by asking questions that allow students to think freely according to their interests and abilities in expressing mathematical ideas and open-ended question.

In the Pictorial (P) component, the elicited visual representations are expressions of mathematical ideas that students display to solve the problem. Starting from ideas raised by students using their language, the teacher can help students to express the mathematical ideas into visual representations through questions that only invite one or several limited responses and usually move directly to one conclusion, that have definite and limited answers.

The symbols that appear in the Symbol (S) component help students to understand the mathematics that is mostly abstract. Symbols in mathematics represent a concept or idea so that in this component, students are expected to use symbols to express mathematical ideas. Questions asked by the teacher can help students change their ideas or make transitions from image to symbol representation. Thus, to promote mathematical symbols related to students' mathematical ideas, the questions posed can be the ones requiring students' imagination and creative thinking. The S component in ELPSA still requires students to practice in symbol manipulation [9].

The last component is Application (A), an important component in learning [9] because applying mathematical concepts in everyday life is important so that students can retain the mathematical ideas acquired in the long term memory. By asking the appropriate questions on the A component, teachers guide students to use the knowledge they learned to solve daily life problems or more complex problems. The questions requiring students to integrate or analyze the information memorized, and to assess the information and to give one correct answer aim for students to solve more complex mathematical problems in daily life.

Several studies related to ELPSA have been conducted, including the suitability of student activities with the activities of each ELPSA component [11]) and student understanding through ELPSA [12]. There are limited studies discussing the suitability of teacher questions with ELPSA each component.

The ELPSA framework has the potential to develop teacher questions that support student understanding in mathematics learning. Therefore, the researchers assisted teachers in designing questions to enhance the quality of teachers' questions, to be in line with the ELPSA framework. Mentoring in the form of discussion about questions conforming each component of ELPSA framework was conducted as a follow-up activity to develop the quality of teacher's questions. The follow-up activities are strategic to ensure the result of the training will be implemented continuously [13].

The previous description indicates that the quality of the teacher's questions in mathematics learning can be related to ELPSA framework. Therefore, this study aimed to investigate the development of suitability of teacher questions in mathematics learning based on ELPSA framework.

2. Method

The present study is part of broader research aiming to develop mathematics learning for the topic of cube and cuboid for junior high school students. The broader research was collaboratively designed by the authors of this paper and P4MRI Unsyiah team. Mathematics learning based on the ELPSA Framework [9] was designed for three lessons using a design research approach [14]. One of the three lessons of the mathematics learning designed has been described in [15].

This study was conducted in one of the public junior high school in Banda Aceh, Indonesia. The participant of this study was a female mathematics teacher and 32 Year 8 students. The teacher was chosen as the participant because she has actively participated in the socialization of the ELPSA Framework organized by P4MRI Unsyiah team. She has also actively updated her knowledge of mathematics learning, and she was willing to be the model teacher in this study. After each lesson, the researchers accompanied the teacher to reflect on the learning and provided mentoring to help the teacher focus on the right questions relevant to the ELPSA framework.

This paper discussed the profile of teacher's questions during the mathematics learning. By paying attention to several types of questions raised by [16], [17], [18] and [19], the researchers classified teacher' questions into four types, namely factual, convergent, divergent and evaluative questions. The researchers then compared the questions posed by the teacher to the expected questions in the designed lesson plan. The expected type of questions proposed in the lesson plan is presented in Table 1.

Data collection involved an observation sheet about teacher's questions and video recordings of the mathematics learning as well as the reflection session after each lesson. The data were then analyzed qualitatively following the steps proposed by Miles and Huberman, namely data reduction, data presentation, and conclusion/verification [20].

Table 1. Description of lesson plan based on ELPSA component

Lesson	Learning goal(s)	Activities
I	- Identifying elements of cubes and cuboids	**E and L Component** - Observing model and frame of cubes and cuboids
	- Determining and drawing cube nets	**L and P Component** - Playing an online game, namely "*Game Cube Nets*" - Using six pieces of squared *Post-It* to determine and draw cube nets
	- Finding the pattern of cube nets	**S Component** - Grouping cube nets based on their characteristics
	- Solving problems about cube nets	**A Component** - Problem-solving
II	- Drawing cuboid nets	**E, L and P Component** - Using six pieces of rectangular *Post-It* to determine and draw cuboid nets
	- Finding the formula of the surface area of cubes and cuboids	**S Component** - Determine the area of cuboid net
	- Determining the surface area of cubes and cuboids	- Solving routine-problems
	- Solving problems related to the surface area of cubes and cuboids	**A Component** - Problem-solving
III	- Finding the volume formula for cubes and cuboids	**E, L and P Component** - Solving routine-problems
	- Finding the relation between the surface area the volume of cuboids by comparing their layout position	- Using rice to fill in two models of cuboids formed by four cards
	- Solving problems related to the surface area and the volume of cubes and cuboids	**P, S, and A Component** - Arranging unit cubes to form buildings given front and side view

Note: See [15] to find a more detailed description of the activities in Lesson 3

3. Result

This section describes the examination results of the development of the suitability of teachers' questions in mathematics learning based on the ELPSA framework. The analysis of the lesson plan developed will be presented, followed by the analysis of the teacher's questions in the classroom.

3.1. Questions in the lesson plan developed based on ELPSA framework

The data of this study was gathered through an experiment consisting of three lessons. The lesson plan provided an example of questions for the teacher to pose in the classroom. To examine the suitability of the planned questions and the actual questions posed by the teacher, the researchers focused on the oral questions posed by the teacher, assuming that questions written on the student worksheet must be suitable with the actual questions.

The types of questions intended to appear in the E component of ELPSA was a factual question such as *Do you still remember the cube nets? How many different nets of cube do you know?* and so on. In the L component, following its characteristic, the proposed questions were factual (such as *What do you know about cube nets?*), divergent (e.g., *What are the similarities and differences between nets*

of cube and cuboid?) and convergent questions (*What is the difference between capacity and volume?*).

Mathematical ideas previously expressed verbally then should be expressed in a more abstract form, using pictures and symbols. In the P component, the teacher should pose a convergent question that has definite and limited answers (such as *Which models are the nets of a cube? Why?*). Sometimes, the questions need students' imagination that will emerge through the divergent questions (such as *Do the cube nets have a similar pattern with the cuboid nets?*). The S component also required more of students' imagination and creativity. Therefore, the suitable question for this component is a divergent question combined with convergent questions.

In the last component of ELPSA, the Application component, students should be guided to solve daily life problems or more complex problems by applying the knowledge they learned. Therefore, the questions proposed in this component were evaluative questions such as *The ratio of the length: width: height of a cuboid is 5 : 4 : 3. If the height is 15cm, the surface area of the cuboid is ...*

3.2. Teacher questioning practice during mathematics learning

During the teaching experiment, the observers recorded the teacher's questioning practice using the observation sheet and video recorder. The analysis of teacher' questioning practice based on the field observation and the video transcription is presented in the following section.

3.2.1. Teacher's questions elicited in the Experience component. The Experience (E) component of ELPSA should enable students to develop mathematical ideas based on their personal experience and understanding *[9]*. Therefore, the type of questions used in this component was a factual question that recalls the topics students have learned and explore students' experiences related to the material to be studied.

In the first lesson, the teacher recalled students' memory concerning cubes and cuboids by reminding them of the lessons in elementary school, followed by their experience of gifting to their friends.

The Experience component in the first lesson

1. T : Have you learned about cubes and cuboids when you were in elementary school?
2. S : Yes, we have.
3. T : Ok. In daily life, we find and use many cubes and cuboids [object]. Who can mention where we use it?
4. S : Box for snacks.
5. T : Ok, what else? Do you often bring gifts for a friend's birthday?
6. S : Yes.
7. T : Ok, usually, what do you use to put the gift?
8. S : Box.
9. T : What did you do to make the box beautiful?
10. S : We use a wrapping paper.

The E component in the second lesson was started by recalling what students have learned in the previous lesson that was about cube nets.

The Experience component in the second lesson

1. T : Do you still remember about the previous lesson? What did we learn about?
2. S : Cubes.
3. T : About cubes. What did I explain yesterday? What were we looking for yesterday?
4. S : Cube nets.
5. T : Ok. The cube nets. Do you still remember about the nets?
6. S : Yes.
7. T : Ok.
8. T : Ok. Yesterday you already made the nets. What have we done with the cube nets?

9. S : Patterns.
10. T : Ok, patterns. What else?
11. S : Formula.

In the third lesson, the teacher started the E component by recalling the previous topic they have learned.

The Experience component in the third lesson

1. T : Today we will continue our lesson. Who still remembers, what were we learned yesterday?
2. S : Determine the surface area of cubes and cuboids.
3. T : Ok. Do you still remember the formula for the surface area of a cube?
4. S : Cube? $6s^2$.
5. T : 6 times s to the power of 2.

⋮
[discussing the surface area of cuboids]
⋮

6. T : How about the formula of the surface area formula of cubes?
7. S : 6 s to the power of 2
8. T : s to the power of 3 or s to the power of 2?
9. S : s to the power of 2.
10. T : Why s to the power of 2, not s to the power of 3?
11. S : Because we do not determine the volume.

The three learning excerpts above were taken within two minutes, during the opening activity consisting of the E component of ELPSA. Based on the excerpts, it seemed that the teacher tended to ask short questions, repeated the students' answer, and then moved to the other short questions. These short questions are typical of factual questions, requiring a simple answer and investigating the memory. However, in the excerpts of the third lesson, line 10 was considered a convergent question.

Generally, during the E component for the three lessons, it seems that the teacher posed factual and divergent questions. Table 2 summarizes the type of questions posed by the teacher in the E component for each lesson.

Table 2. Type of the teacher's questions elicited in the Experience component

Lesson	Factual	Convergent	Divergent	Evaluative
First lesson	8	12	0	0
Second lesson	6	14	0	0
Third Lesson	4	4	0	0

3.2.2. Teacher's questions appears in the language component. Exploring mathematical ideas from students' experience and knowledge will result in various terms or language commonly used by the students. The teacher should explicitly help students to use a proper term, which is the L component of ELPSA *[9]*.

Table 3. Type of the teacher's questions appeared in the Language component

Lesson	Factual	Convergent	Divergent	Evaluative
First lesson	1	4	5	2
Second lesson	1	3	2	1
Third Lesson	0	2	8	5

Table 2 summarizes the type of questions posed by the teacher in the L component for each lesson. In the first and the second lesson, the teacher posed four types of question in the L component, whereas in the third lesson, there was no factual question posed.

3.2.3. Teacher's questions elicited in the Pictorial component. The Pictorial component engages students to encode and decode the information gathered *[9]*. As presented in Table 4, the teacher posed three types of question in the first lesson, namely factual, convergent, and divergent questions. In the second lesson, the teacher only used divergent questions, while in the last lesson, the teacher posed divergent and evaluative questions.

Table 4. Type of the teacher's questions elicited in the Pictorial component

Lesson	Factual	Convergent	Divergent	Evaluative
First lesson	5	8	5	0
Second lesson	0	0	3	0
Third Lesson	0	0	4	1

Table 4 shows that over time, the teacher reduced asking factual and convergent questions which can be classified into lower-order level questions. While in the first and the second lesson, the teacher mostly asked factual and convergent questions, in the third lesson the teacher mostly asked divergent and evaluative questions such as "*How many boxes can be added without changing the appearance?*" and "*Why is the volume of horizontal model more than the vertical ones?*"

3.2.4. Teacher's questions elicited in the Symbolic component. The S component involves students' ability to represent gathered information symbolically *[9]*, a more formal way than the picture representation. The types of question asked by the teacher during her lessons are presented in Table 5.

Table 5. Type of the teacher's questions elicited in the Symbol component

Lesson	Factual	Convergent	Divergent	Evaluative
First lesson	3	6	13	12
Second lesson	0	2	12	1
Third Lesson	0	0	1	1

Table *5* indicates that during the first lesson, the teacher used the four types of questions, with the proportion of divergent and evaluative questions was greater than the factual and convergent questions. The use of the factual question decreased in the second lesson, while in the last lesson, there were no factual and convergent questions posed by the teacher.

3.2.5. Teacher's questions elicited in the Application component. In the Application component of ELPSA, the teacher should provide activity enabling students to solve a more complex or daily life problems by applying their knowledge. In this component, the most suitable question is divergent and evaluative components. Table 6 summarizes the types of the question posed by the teacher during the teaching experiment, in the Application component of ELPSA.

Table 6. Type of the teacher's questions elicited in the Application component

Lesson	Factual	Convergent	Divergent	Evaluative
First lesson	0	0	3	0
Second lesson	0	0	3	3
Third Lesson	0	0	2	1

In the Application component of the first lesson, the teacher only posed divergent questions such as "*If the lateral edge of a cube is 12cm, determine the volume of the cube*." Whereas, in the second and

the third lesson, the teacher started to pose divergent and evaluative questions such as "*Why the length is 25cm*?" and "*Why do you divide it by 3, not by 4 or 5?*"

4. Discussion

A teacher should not only grasp the subject matter but also must be expert in specialized knowledge related to students' learning characteristics and ways of thinking. The knowledge of subject matter is not enough to carry out effective learning; thus, the teacher must also have general knowledge about pedagogics. Boz & Boz [21] argued that pedagogical knowledge is important for all teachers because it includes general knowledge about teaching, such as classroom management, giving guidance, questions, and feedback.

This study was conducted in three lessons. The observations of the learning process of the first to the third lesson showed different achievements. The results indicated that the teacher's questions have been more suitable for the type of questions proposed in the lesson plan. The quality of the teacher's questions has evolved based on the ELPSA framework in each lesson. This is in line with Lowrie and Patahuddin's opinion that ELPSA framework views learning as an active process where students construct their ways to understand new mathematical knowledge through individual thinking processes and social interactions; so that the framework can accommodate teachers to ask questions on each component [9].

The types of factual questions raised by the teacher have developed. In each lesson, the teacher increasingly focused on submitting the factual type of questions to the expected components, namely the experience (E) component. The expectation was that, based on the characteristics of the E components of the ELPSA framework, the activities carried out by the teacher are to remind students of their experiences related to the material to study. This is consistent with [19], actual questions are questions examining one's memory, and remembering repeated or practiced information. In the first lesson, the teacher submitted a type of factual question to the four components of ELPSA: Experience, Language, Pictorial, and Symbol components. In the second lesson, the teacher posed factual questions to the E and L components. In the third lesson, the teacher proposed factual questions only to the E component.

The appearance of factual questions conforming the ELPSA component was possible because of the assistance given by the researchers at the end of each learning activity. During the reflection session between the teacher and the researchers, the researchers supported to the teacher by providing feedbacks about her weaknesses and strengths so that she can accept them positively and dynamically for her self-development. This is in accordance with [22] who stated that guidance is a process of providing assistance to individuals, that is carried out continuously so that the individual can understand himself, can direct himself and can act reasonably according to the demands and circumstances of the school environment, family, and public.

The emergence of convergent questions developed in each lesson. This development was seen in the second and third lessons. In the first lesson, the convergent questions appeared in the E, L, P, and S components. In the second lesson, convergent questions emerged in the components of E, L, and S, while in the third lesson, the convergent questions appear in the E and L components. In the second lesson, the convergent questions reappeared in the S component, even though after the first lesson, the teacher and researchers had discussed that the convergent question was inappropriate to be submitted to the P and S components. The recurrent convergent question in the S component in the second lesson became a subject of discussion between the researchers and the teacher. The emergence of the convergent questions in the S component was said to be inappropriate because [9] believed that the S component requires children to practice in symbol manipulation, thus, in this component students require higher-order questions. Therefore, convergent questions should not appear in this component.

After conducting discussions at the end of the second lesson, the change of the emergence of the convergent questions was seen in the third lesson. The teacher seemed to focus more on asking this type of questions in the E and L components. The teacher should focus on asking convergent questions on the E and L components because the teacher should remind students of their experiences related to

the material to study in the E component, and students can express the mathematical ideas using their language in the L component. It is in line with the purpose of the convergent questions that is to produce short responses from students and to focus their attention on the lower-level of thinking.

The divergent questions submitted by the teacher appear in each lesson. In the first lesson, the divergent question appeared in the L, P, S, and A components. The emergence of divergent questions on these four components was appropriate because the divergent question is an open question allowing many answers and students to be more creative. This is in line with the opinion of [18], that divergent questions lead to a series of responses and focus on different questions and strategies. The divergent questions also lead to a more extended response. In the second and third lessons, the teacher posed divergent questions in the four components of ELPSA, the L, P, S, and A components. The appearance of the divergent questions in the four components was consistent from the first lesson; therefore, it can be concluded that there is no development in each lesson related to the appearance of the divergent questions.

The evaluative questions submitted by the teacher in the first lesson appeared in the two components of ELPSA, in L and S component. The emergence of evaluative questions in the L component was one of the efforts to encourage students to express mathematical ideas using their language. Students can think more creatively by solving mathematical problems requiring assessment. As to the emergence of evaluative questions in the S component, students can better understand the meaning of the symbols formed based on mathematical ideas. In the second lesson, the evaluative questions appeared in three of ELPSA components, the L, S, and A components. The emergence of evaluative questions in the A component of the second lesson was considered as development. This is because, at the first lesson, there was no evaluative question in the A component. The emergence of the evaluative question on the A component was appropriate because students should be presented with more complex mathematical problems in the A component.

In the third lesson, the evaluative questions appeared in the four components of ELPSA, in the L, P, S, and A components. The emergence of evaluative questions in the S component can help students understand the meaning of the symbols associated with mathematical ideas. This is because the use of symbols helps students to understand mathematics topics that are mostly abstract. This is in accordance with [9] stating that the Symbol component in ELPSA requires students to practice symbol manipulation.

The development of teacher questions on the factual, convergent, and evaluative questions relevant to the ELPSA component can benefit the students in solving PISA-like problems. This is in accordance with [23], saying that PISA content in mathematical literacy is related to students' ability to analyze, reason and communicate effective ideas because they describe, formulate, solve and interpret mathematics problems in various situations. Based on the results, it can be concluded that there was a development of the suitability of the questions posed by the teacher with the expected questions in the ELPSA framework

5. Conclusion

This study highlights the suitability of teacher's questions on mathematics learning based on the ELPSA Framework. The fact that there is more conformity between the types of questions asked by the teacher and the type of questions expected in the ELPSA framework component indicates the development of the quality of questions posed by the teacher.

The factual question was expected to appear in the Experience component dominantly. In the first lesson, the teacher posed factual questions in the E, L, P, and S components. In the second lesson, the emergence of factual question decreased into two components, E and L. In the last session, the teacher posed a factual question in the expected component, the E component.

The convergent questions were most suitable for the Language component. In the first lesson, the teacher posed the convergent questions in each ELPSA component. The appearance of the convergent questions kept decreasing. In the second lesson, it appeared in the E, L and S components, while, it only appeared in the E and L components in the third lesson.

The evaluative question was expected to appear in the Application component mostly. In the first lesson, this type of question did not appear in the expected component, but in the L and S components. The appearance of this type of question changed at the second and the third lessons. In the second lesson, it appeared in the L, S, and A components, whereas it appeared in the L, P, S, and A components in the third lesson.

The appearance of divergent questions did not significantly change in this study. It consistently appeared in L, P, S and A components of each lesson, whereas it is expected to appear at the L and P components mostly.

The four types of questions elicit in each component of the ELPSA framework. However, it is necessary to conduct a further study about the suitability of each component of ELPSA framework, the types of question, and the topics of mathematics.

References

[1] Amien M 1987 *Mengajarkan Ilmu Pengetahuan Alam dengan Menggunakan Metode Discovery dan Inquiry* (Jakarta: Depdikbud)

[2] Arslan M 2006 The role of questioning in the classroom *Hasan Âli Yücel Eğitim Fakültesi Dergisi* **2** 81-103

[3] Palincsar A and Brown A 1984 Reciprocal teaching of comprehension-fostering and metacognitive strategies *Cognition and Instruction* **1** 117-75

[4] Shen P and Yodkhumlue B Teacher's questioning and students' critical thinking in college EFL reading classroom *The 8th International Postgraduate Research Colloquium: Interdisciplinary Approach for Enhancing Quality of Life IPRC Proc.*

[5] Fauzan A 2002 *Applying Realistic Mathematics Education (RME) in teaching geometry in indonesian primary schools* (Enschede: University of Twente)

[6] Tofade T, Elsner J and Haines S T 2013 Best practice strategies for effective use of questions as teaching tool *American Journal of Pharmaceutical Education* **77** 155

[7] Gose M 2009 When Socratic dialogue is flagging: Questions and strategies for engaging students *College Teaching* **57** 45-50

[8] Wilson L O 1997 *Newer Views of Learning-Types of Questions*

[9] Lowrie T and Patahuddin S M 2015 ELPSA–Kerangka kerja untuk merancang pembelajaran matematika *Jurnal Didaktik Matematika* **2** 94-108

[10] Van den Heuvel-Panhuizen M 2000 Mathematics education in the netherlands: A guided tour *Freudenthal Institute CD-rom for ICME9*

[11] Syahdan S 2017 The effectiveness of the implementation of Experience, Language, Pictorial, Symbol, and Application (ELPSA) in mathematics learning based on Bruners theory to class VII students at SMPN 29 in Makassar *Jurnal Daya Matematis* **4** 192-206

[12] Johar R and Hajar S 2016 Implementation of ELPSA Framework in teaching integral using technology *International Journal of Science and Applied Technology* **1** 15-21

[13] Firiana R 2013 Pengaruh pendekatan Pendidikan Realistik Matematika dalam meningkatkan kemampuan komunikasi matematis siswa Sekolah Dasar *Proc of SEMIRATA 2013* **1** 225-38

[14] Gravemeijer K and Cobb P 2006 Design research from a learning design perspective *Educational Design Research* 29-63

[15] Khairunnisak C, Elizar E, Johar R and Utami T P 2018 Teachers' use of the learning resources in spatial learning *Journal of Physics: Conference Series* **1088** 012035

[16] Moeller M and Moeller V 2013 *Middle School English Teacher's Guide to Active Learning* (Abingdon: Routledge)

[17] Gagnon G W and Collay M 2001 *Designing for Learning: Six Elements in Constructivist*

Classrooms (California: Corwin Press)

[18] Orlich D C, Harder R J, Callahan R C, Trevisan M S and Brown A H 2012 *Teaching Strategies: A Guide to Effective Instruction* (Massachusetts: Cengage Learning)

[19] Moore K D 1994 *Effective Instructional Strategies: From Theory To Practice* (California: Sage Publication)

[20] Miles M B And Huberman A M 1994 *Qualitative Data Analysis: An Expanded Sourcebook* (California: Sage Publications)

[21] Boz N and Boz Y 2008 A qualitative case study of prospective chemistry teachers' knowledge about instructional strategies: Introducing particulate theory *Journal of Science Teacher Education* **19** 135-56

[22] Sukardi D K 2000 *Pengantar Pelaksanaan Program Bimbingan Dan Konseling Di Sekolah* (Jakarta: Rineka Cipta)

[23] OECD 2009 *PISA 2009 Assessment Framework: Key Competencies in Reading, Mathematics and Science* (OECD)