The Role of Lesson Study to Improve Posing Question Skills of Teacher and Students in Problem Based Learning

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Abstract: Posing question is a part of the interactions in the classroom, which represents thinking process of the person who asking question. The skill of posing question can be improved through lesson study. The research objective was to determine the role of Problem-based Learning based Lesson Study on the competence of teachers and students in asking questions. The research was a quasi-experiment, wich was participated by senior high school students as subjects of the research. Two homogenous classes was selected as samples by purposive random. Teacher and students' competence was improved through Lesson Study, which consisted of plan, do and see. Questions were analyzed quantitatively and qualitatively based on revised Bloom Taxonomy. Quantity of questions was analyzed by Manova. Results of the research: 1) lesson study had significantly improved teacher and students' skills on asking questions; 2) The quality of teacher and students' questions expanded into high dimension of knowledge, but no metacognitive questions were found; 3) The level of cognitive of students and teacher increased to the highest level (C6), but in a few number; 4) Teacher competence was argued has relevant influence to students' skills on asking question

Keyword: thinking, problem-based-learning, Lesson-study, question

1   INTRODUCTION

Question is part of a complex interaction, and communication is needed in globalization era's (Galbreath, 1999; Silva, 2008; Darling-Hammond & Adamson, 2010). Those are a learning product (Trilling & Fadel, 2009). Interaction might be questions and statements between teachers and learners that occur in learning process, includes in high school biology learning. In fact, interaction in the classroom is more dominated by teacher in the form of affirmation or repetition of learners questions (Oliveira, 2010). Questions and statements are a process as well as the outcome of the interaction of teachers and learners (Khortagen, et al. 2014). Other forms of interaction are an explanation and assessment (McFarlane, 2013). Therefore, the interaction and complex communication which are represented by questions, explanations, statements and assessment are for the subject matter, which according to Wilson and Jan (2008), all of interaction, in particular questions in the class requires thinking process.

Interaction between teachers and learners affect cognitive, emotional, motivational and behavior of learners'., It means that the quality of the interaction of teachers and learners increase the quantity and the quality of the activities during the learning process, stimulate the feeling comfortable in school and improve the academic level and competencies and learning outcomes of students, which has been generally known as intellectual abilities (Khortagen, et al. 2014). Tan (2004); Sutman, et al. (2008) stated that the increasing of learner activities can be identified through the quantity of questioning. And the quality of teacher competence can affect both the quantity and the quality of the questions that learners deliver in the class during learning process. Questioning also reflects the level of thinking. Chin (2004); Wilson and Jan (2008) stated that the question is a key activity for meaningful learning, which serves as a tool to explore the psychology of thinking, looking for ideas, directing thinking, developed the concept through the phenomenon, which consists of three categories: consolidation, exploration and elaboration. Based on the function of questioning as a tool to develop the thinking process of learners, In other world the question can be serving as a part of process to solve problems, in which learner construct the new knowledge. It is necessary to identify the level of thinking of learners.

Questioning in learning is part of the interaction that can be constructed through communication. The communication in the classroom has to be designed in the instructional learning design which should promote the comfortable atmosphere for learners to participate in the learning process. Gallager & Gallagher (2013) suggested that a positive relationship between students and teachers is necessary for growth and health of the soul that can foster intrinsic motivation to achieve the maximum outcome. Therefore, it becomes necessary to analyze the competence of teachers to address the comfortable learning process.Questions, statements, explanations and assessments in the learning process are accommodated through the learning instructional methodologies. Each instructional methodology has a specific stage during the learning process with varied percentage of questions, statements, explanations and assessments. Learning methodology that accommodates the needs of the 21st century is a model that cover the needs of communication, especially on non-routine interaction (Darling-Hammond Adamson, 2010), analytical skills and interpersonal skills (Burrus, et al. 2013). Non-routine communication has meaning unusual and can only be done using a complex phenomenon and analysis. The complexity of the phenomenon is found in the complex theme. Therefore, the problem being studied is a complex and ill structure problem, which requires logical explanation by learners through investigation and research. The process of investigation related to the concept which is constructed by the learner is more stimulated than learners' curiosity which is characteristics of inquiry learning (Callahan & Kelogh, 1999; Borich, 2006; Sutman, et al. 2008). While the questions actually to train learning to think about the relationship between events, experiences, test relating to the events they want to know, which is is necessary to determine a conclusion (Wilson & Jan 2008).

Question is the central of curiosity, can be serves to break the idea of the topics being studied and to build linkages knowledge that has been owned (Gallager & Gallagher, 2013). Gillies, et al. (2012) stated the question of learners in the process of investigation is as a role in the process of creative thinking by explaining ideas and new experiences, developing new understanding to solve problems. Munte & Rogne (2015) stated, the question skill is the attitude that is required to conduct an investigation on the ill structure of the complex theme, but the question of the teacher in learning is the repetition or the reassertion of answers learners (Oliveira, 2010).

Analyzing the complex themes of ill structure require more steps to support the completion of the investigation. Ill structure problem in investigative research requires knowledge, which can be designed in a Problem Based Learning (PBL) (Tan, 2003, Tan, 2004; Gallager & Gallager 2013). PBL begins with complex themes and questions (Tan, 2003; Tan, 2004; Tan, 2006; Leite, et al., 2011).While the question itself visualize the thinking abilities (Wilson & Jan, 2008; Chin, 2004; Osborne 2013). For that reason, analyzing the quantity and quality of the questions of teachers and learners' shows changes the ability teachers and learners. PBL has a learning stages: 1) Meeting the problem; 2) The problem analysis and learning issues; 3) Discovery and reporting;, 4) Solution presentation and reflection; 5) Overview, integration and evaluation (Tan, 2003). Questioning and providing complex theme are the earliest stage of PBL. Both in real terms are difficult to implement. The first difficulty of the implementation of PBL that was encountered problems due to the ill structure which requires a contextual phenomenon with a complex theme (Chin & Chia, 2005). Ill structure problem is a problem that requires completion because it contains curiosity, which is a core of inquiry learning.

Contextually in the complex theme is a necessary requirement to prepare instructional design. Kunter, et al. (2013) stated, that the self-regulation on instructional design is one measurement of the competence of teachers that affect learning outcomes. Teacher competence is measured by organizing lesson plans based on a

contextual learning (Argote & Miron-Spektor, 2011). Investigation on the daily complex theme requires organization of knowledge and learning processes that lead to a direct interaction with the object being studied (Leite, et al., 2011). Self-regulation settings for instructional design and implementation on the learning process reflect competence of teachers conducted by the Lesson Study (LS) (Elliott, 2012), which consist of three stages: plan, do and see (Toyoda, 2012; Susilo, et al. 2011). Based on the question visualization of thinking there is an assumption that the change of competence using PBL can change the quality and quantity of questions teachers and learners. Plan in LS is a piece of discussion among teachers to gives reinforcement to learn together. Teacher has varied time and academic experience, which can rise the pattern of learning among different teachers (Bergh et al., 2015). Do in LS is the realization of the lesson plan among by the teacher. See in LS is a follow-up to evaluation an instructional design and learning activities that have been carried out. Based on LS teacher competence can be change (Ylonen & Norvich, 2013). Therefore mastering teacher in LS can affect the quality and quantity of the question teacher and learners. The research objectives are: 1) identify the role of LS on the competence of teachers using PBL that affect the quantity and quality of the question of teacher and learners; 2) describe the change thinking process based on questions of learners as the effect of changes in teacher competence after using PBL.

2 RESEARCH METHODS

The research is a quasi-experimental research, which is pretest-posttest non-equivalent control group design (Sugiyono, 2013). Population was biology teachers and learner on senior high schools in Surakarta. The samples were selected by purposive random sampling consideration the average of intellectual abilities learners' (Sajidan, et al. 2012). The number of students participated was 63, divided into treatment class are 32 person and control class are 31 person.

Competence of nine biology of teacher was improved by LS. There were three cycles with 12 times meeting. Plan activities comprise: 1)

designing learning instrument by nine biology teacher. Learning instrument based of Tan (2003) consists: 30% meeting the problem; 20% analyzing and learning problems issues; 15% discovering and reporting; 15% solution presenting and reflecting; 20% overviewing, integrating and evaluating; 2) determining the proper way to study according to the material; 3) modeling of teaching PBL. Do is a real activity in the class Do require observation for learning activities teacher and learners'. Observations can be done by biology student who were involved in the completion of the final task. See on LS is the reflection phase, which is conducted at the end of the learning process. Instrument to measure teaching competence based on feasibility can be achieved at the stage of PBL by the teacher. Measuring tool is based on the material that stage was adopted PBL (Tan, 2003), in accordance with the assessment of inquiry (Forbes & Davis, 2010).

Question teacher and learners were analyzed qualitatively and quantitatively before and after the implementation of the LS. Qualitative analyses for learner questions use the rubric by category thinking process of Anderson & Krathwohl, et al. (2001). Analysis before the LS is a pre-test and after teachers implement LS is a post-test. Analysis of quantity question learners tested with Anova.

3 RESULTS

The feasibility stage as the teacher competency on learning process of PBL at the first to four cycle LS as shown in Figure 1.
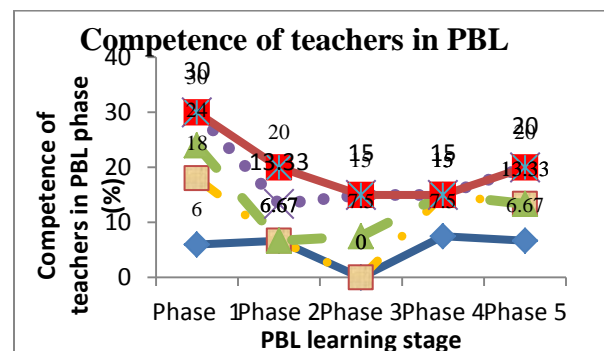

Figure 1. Competence of teachers in stage of PBL on cycle 1, 2, 3 and 4 compared to the standard of competence.

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Analysis LS of teacher competence using PBL on four cycle is not yet to the standard of competence, especially in phase 2. Phase easiest possessed by teachers is a stage fourth. The most difficult possessed is first and fifth stage. Furthermore, the analysis of the ability of teachers in the stage of analysis and learning problem issues was identified by questions relating to requests for learners to groups. The ability of teachers to accommodate learners determines problems studied as a follow further from the ill structure has not reached the standard in fourth cycle.

The general questions of teachers in the class control are more than in class treatment. The number of questions the teacher in the class treatment decreased for question of the dimensions facts and concepts, increased to dimensions of procedural and metacognition. There is difference in the pattern of the quality and quantity of teachers' questions before and after LS. Teacher question in the control class is more than on the conceptual dimensions, where as in fact, the procedure and metacognition decreased or unidentified. Analysis of the quantity and quality of the teacher's questions before and after LS in the class treatment and control can be change the quality and quantity of teachers' question. Therefor those LS assumed influence of teacher competence. Kleickmann, et al. (2012) stating that the competence of teachers comprising teaching skills and knowledge affect the progress of learners, including the more meaningful interaction, especially on the question of learners

Analysis of the quantity of questions learners indicate: 1) the quantity of questions on knowledge of the factual dimension in grade control and treatment different significant $F = 47,276$, with ($p < 0.05$); 2) the quantity of questions on the conceptual dimensions in class treatment and control group showed different significant $F = 39\ 355$, with ($p < 0.05$) and sig. 0:00, meaning that the question of students in conceptual dimension exhibited significantly increased; 3) the quantity of questions on the procedural dimension in the class of treatment and significantly increases control class $F = 37$

209, with ($p < 0.05$) and sig. 0:00; 4) The quantity of questions of students in the class dimension of metacognition increase no significant $F = 1.000$, with ($p > 0.05$) and sig. 321. Analysis of the quantity and quality of questions learners and teachers before and after the LS in class treatment there is raising questions learners on the dimensions of the factual, conceptual, procedural, and not significant in the dimensions of metacognition.

Distribution of questions learners and teachers in control class on Table 1 is clustered at the level of thought C1 and C2, while the level of thinking C3, C4, C5 and C6 did not change the number of questions learners. Analysis of distribution quantity and quality of the questions teachers and learners in the class treatment more widespread at all levels to think in quantity and quality. Quality and quantity in treatment class is better than before LS. LS assumed change teachers competence especially to improve the quality of teachers and learners question. Competency of teacher can be change by LS effect of the quality and quantity questions learners on facts, concepts, procedures and metacognition dimensions and all levels of thinking.

4   DISCUSSION

LS mechanism is assumed to gradually increase the ability of teachers in the learning PBL which shown the stages reached LS. All of stage does not yet to the standard until the fourth LS especially on stage of problem analysis and learning issues (Figure 1). The ability of teachers at this stage of problem analysis and learning issues confined to the instructions for preparing the working group in accordance with the theme chosen. Supporting components problem analysis and learning issues such as determining the topics and goals have not been identified, its means there is difficulty to find the topics and issues in particular ill structure in PBL. Ill structure is characteristic of PBL (Tan, 2003; Tan 2004; Tan 2006; Gallagger & Gallagger, 2013). Analysis and learning issues is an important step which shows the characteristics of PBL (Sockalingam & Schmidt, 2011), because by learning to analyze the issue

in real life is a real form of problem-solving exercises. Unlike Chin & Chia (2005) stated, in PBL biology real life leaners' found difficulties learners' on stage determining the problem ill Structure, thus the difficulties learners are more commonly at stage of meeting the problem. Learners and teachers were found to be on different stage to mastery of stage PBL. Teacher's ability to stage the problem meting prepared in instructional design organization compiled before learning activities through plan in LS. Complex theme on instructional design is easily found around accommodated life through communication forum for discussion with biology teachers group. Teachers' difficulty on stages of problem analysis issues not sufficiently accommodated with a discussion in LS. To solve difficulty requires extensive knowledge of the completion of the complex theme of the design that had been developed previously. Teacher teaches by Instructional design composed before get responses learners' unpredictable. Knowledge, management class, skill in managing the follow-up of ill structure and keep curiosity learners to the solution of complex problems components, causing teachers and students are encouraged to learn more.

Capabilities of teachers is part of competence, Kunter, et al. (2013) state, teacher competence is the mastery of knowledge, skills, motivation of all forms of domination basis on the specific situation, therefor to get teacher competence using PBL requires LS is to discussion, share, training and objective assessment of the performance of the teachers, that are reason to the mastery of stages in LS for PBL. Stages on LS are easily understood by the teacher is the solution presentation and reflection. Ability of teachers needed at this stage of solution presentation and reflection is as a facilitator, who encourages learners resolve the issue of its investigation. Monitoring of teachers who serve to keep the motivation and performance of learners is a necessary part of the solution stage presentation and reflection. Stages on LS are relatively more difficult possessed by the teacher is meeting the problem and overview, integration and evaluation, which

can be understood by teacher on the second LS. LS is only capable of repairing the specific stages, therefor needed focus of the weaknesses of the learning process identified before. Indonesian education system has a big quantity and low quality of teachers in the knowledge, skills commonly, therefor a factor to be considered to improve the teacher competency massively. Teacher has personal differences to be variations in the difficulty to be resolved a problem. Results of the analysis showed that by once or twice LS does not necessarily increase the overall competence of teachers, it means there are any special competence requires practice specific.

Improving the ability of teachers to change using PBL affects the entire interaction in the learning process, especially on the quantity and quality of learners' questions. Statistical analysis showed a significant difference in the quantity of questions learner' at the factual, concepts, procedures dimensions accordance with the improvement of teacher competence. Although the question of metacognition dimension increase in class treatment, but no significant in statistically. Analysis quality and quantity of questions learners' at the LS cycle to change teacher competence is an interesting. Increasing the competence of teachers using PBL can affect to the distribution of questions learners. Earliest LS question learners' accumulates at the level of thinking C1, C2, and C4 in all dimensions and levels of thinking. After LS can be found the level of thinking C3, C4, C5 and C6 in all dimension. Support to the increasing quality and the quantity of questions teacher and learner by increasing competence of teachers are: 1) the role of teachers in PBL learning; 2) interaction between learners and teachers use contextual learning with the theme of the complex; 3) the relationship between the questions is an indicator and the thinking process.

General, the teacher's role in learning is to create emotional situations conducive to learning through events in order to create a learning society and respond to the needs of learners (Reyes, et al., 2012), therefore to create a situation that is supportive emotional

environment that is the maximum for learning to obtained maximum learning results. PBL is a learning that begins with complex a complex theme (Tan, 2003; Tan, 2004: Tan 2004; Gallager & Gallager, 2013), which requires the organization of instructional design by the teacher before. Ability to organize the learning environment and instructional design is a part of efforts to increase higher-level thinking learners (Reyes, et al. 2012). Teacher needed mastery of instructional design in lesson plan to be implemented on class teaching (Ylonen & Norvich, 2013). Lesson plan create by teacher through intensive communication with biology teachers. Complex theme in real life does not become an obstacle to find and take advantage. The roles of teachers in PBL not only organize design instructional on lesson plan, but carry out in real class on teaching and learning. The implementation of teaching and learning PBL requires a teacher's competence in of knowledge, skills and management of the learning process (Kunter, et al., 2013), therefore to learn complex theme in real life useful question.

Complex theme in learning and ill structure problem is a bridge to study problems that unraveled there for it becomes unpredictable for teachers to resolve each problem in learning by learners'. Unpredictable to solve problem by learners influenced on creativity, experience, ability, interaction, IT therefor important to maintain the motivation of teachers, learners' as a learning efforts to solve the problems. The teacher's role more as facilitators and friends to discuss and resolve any problems encountered. Interaction and communication with a variety of sources and experts, as well as the use of IT becomes a very important. The effects of increased interaction and communication can be seen from the quantity of learner question. Increasing knowledge is assumed affects the quality of learners' questions. Interaction between students and teachers use contextual learning with the complex theme is assumed to improve the quantity and quality of questions learners. The supporting analysis assumptions are: 1) the completion of the theme of the

complex through the investigation of the issue requires an object that is used to observe various phenomena because many phenomena affecting the construction of knowledge compiled learners. Guncel (2010) state, through the triangular Experience Pattern Explanation (EPE), the construction of meaningful knowledge through inquiry requires a lot of phenomena. Construction of knowledge through investigation requires the phenomena to solve a problem on research (Sutman, et al., 2008; Kulthau, et al., 2007; Borichc, et al., 2006). To solve problems research requires a wide range of questions support, as a consequence is the increased interaction between teachers and students through the questions and statements. Walls & Sattes, (2011) stated, question differentiated by type and function, therefor question learners' found many types. Questions support of new knowledge based on the facts, especially on facts at the complex theme. Question learner's found on discussion (Chin & Osborne 2008). The question is often used as a bridge to complete the research procedure. Argote & Miron-Spektor (2011) stated that the question needed to organize the learning that contextual is the interaction between the objects with knowledge. Supporting data is shown that the question dominating of facts, concepts, procedures dimension, while metacognition dimension even increases do not significant difference.

The relationships between the questions with the thought process show that in the control class. Question distributed at the level of thought C1 and C2, whereas at the level of thinking C3, C4, C5 and C6 did not show changes, This is due to: 1) design of learning using the learning which is used by teachers in their daily lives. In the control class, there was no preparation for learning instructional design lesson plan by LS; 2) there is no clear stages that become a burden learners and teachers to do for learning; 3) based on a design is not clear and the absence of maximum effort both teachers and learners; 4) the quantity of questions accumulates at the level of thought C1 and C2 is defined during the learning process. Learners do

not get a stimulus to think to solve a complex problem. Solve a problems requires complex thinking process to analyze, evaluate, and create. C1 and C2 is the low thought process (Khan & Inamullah, 2011).

The low level of thinking that occurs in the control classes due to: 1) Learning that do not use complex contextual theme in real life. The use of complex themes and ill problems encountered early stages of learning PBL (Tan, 2003; Tan, 2004; Tan, 2006; Gallager & Gallager 2013). Solve the ill problem requires many observations and questions therefor that learners are trained to analyze 2) The difference between the ability to master in the early and last stages of PBL on the control and treatment class showed that is less a maximum teacher effort to use instructional design for support of leaners' questions. The question learners' and teacher in treatment class shown were distribution spread across on all levels of the thinking process and dimensions. Question learners' at the treatment class an increase shown learners' more in the participation. Tan (2004) stated participation through the questions is useful for: 1) to help increase the understanding; 2) find ways to enhance the strength develop skills process; 3) helps to interact with ideas and construction for the situation of the topic being studied; 4) provide an opportunity to find their own mistakes.

Increasing of distribution of thought process at all levels and dimensions of knowledge as a question learner' assumed by LS. Ylonen & Norvich, (2013) stated that the aim LS is not to knowledge construct, but to boost the participation of learners. Participation of learner in this case is questions. Supported the reason is difference shown in the percentage of mastery of the ability teacher of the PBL stages in class control and treatment. 58.99% teacher competence is a difference between control and treatment class. In principle the LS is designed to obtain a good quality lesson plan structure quality of learning, collegial learning (Lewis, et al., 2012) to obtain maximum results in the learning process. One of learning process is

measured by the quantity and quality of questions learners.

5 CONCLUSION

The ability of teachers to accommodate stages of PBL was obtained through LS affects the ability of supporting competencies to improve the interaction in the learning process. Significant interaction learning process is measured through participation with the quantity and quality of learners' questions. Mastery ability of teachers to influence the PBL stage is the quantity and quality of teachers and learners questions on the dimensions of facts, concepts, procedures, and improve the distribution of the quantity and quality of learners' questions. Quality is a question of the level of thinking visualization.

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