Implementation of Problem Based Learning Combined With Think Pair Share In Enhancing Students’ Scientific Literacy and Communication Skill Through Teaching Biology in English Course Peerteaching

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Abstract. Based on previous researches, it was known that deciding a proper learning strategy is crucially needed to foster students’ 21st century skill through learning activities. This research is a classroom action research with two cycles and uses Lesson Study approach. This research aims to understand the implementation of PBL combined with TPS in enhancing students’ scientific literacy and communication skill. In this research there were one model teacher, four observers and twelve students as subjects. The first cycle was conducted in March 6th 2018 while the second cycle was done in April 4th 2018. Instruments used in this research are observation sheet for observers, worksheet with scoring rubric to measure students’ scientific literacy skill and students’ learning experience questionnaire for students using Likert scale. The results show that students’ scientific literacy skill is increased from 50% in cycle 1 into 79% in cycle 2. Students’ communication skill is also increased from 54% in cycle 1 into 70% in cycle 2. Results from observers show that PBL combined with TPS enhances student’ learning activities and communication skills in class. It can be concluded that the implementation of PBL combined with TPS enhances students’ scientific literacy and communication skill.

1. Introduction
The 21st century offers life in a borderless world, globalization, and the explosion of information and communication technology. The rapid development of technology and information dissemination will result in the expansion of knowledge that will impact the economy, culture and politics of a country. On other hands this global changes the implementation of the education system [1]. Thus, this 21st century students need to be able to solve various problems by thinking effectively and utilize the technology, especially in science education.

Teaching science is to give experience of discovering science concepts through the scientific process, connecting the science with technological advances and their impact on environment and society [2]. Current science education prepares generations to become citizens who can apply their science knowledge to respond socioscientific issues. [3] suggests that science education should help people to have adequate knowledge so that they can make informed choices, engage in science issues and their impact on technology and society, and enrich scientific knowledge needed to work in this era.
Scientific literacy, beside critical thinking, is also a key component of science education which aims at preparing future generations to function as responsible citizens for the advancement of the world affected by science and technology and to understand its impact [4]. [5] suggests that scientific literacy and critical thinking trigger the development of knowledge, attitudes/values, thinking ability, and fostering the ability to take responsible actions in the context and circumstances by their lives and social environment.

Scientific literacy was coined by Paul Hurd in the late 1950 that describes a comprehension of science and its applications to society [6]. Later, [7] defined the concept of science literacy as the knowledge on needs to understand the scientific component of public issues, this knowledge includes a mix of facts, vocabulary, concepts, history and philosophy. More recently, [8] defines scientific literacy as what the public should know about science with everything which is needed are the facts and vocabulary sufficient comprehend the context of the daily news, if everyone can understand scientific issues about genetic engineering or the ozone hole with the same ease that everyone would sport, politics, or arts, then everyone is scientifically literate. The purpose of scientific literacy in education is to build a scientifically literate society, that is, a society that understands science and its relation to social issues [9]. Thus the importance is not only the mastery of the concept of science but rather the ability to think. Scientific literacy involves mastery of thinking and using scientific methods of knowing and addressing social issues [10].

Students’ scientific literacy skill in a certain nation may be measured by Programme of Internasional Students Assessment (PISA). [11] reports Indonesia students’ scientific literacy has mean score about 393. Furthermore, [12] reports Indonesia students’ scientific literacy has mean score about 403. This scores determine that Indonesian scientific literacy skill belongs to level 1a. This level indicates that students are able to use their basic content and procedural knowledge to recognize and identify phenomena scientifically. There are a lot of descriptive research which show Indonesian students’ scientific literacy. Result from [13-17] shows that students have a low scientific literacy skill background. Furthermore, [15] suggest that the lack of scientific skill proficiency is due to inappropriate implementation of learning strategy which is unable to enhance students’s scientific literacy. In other word, the implementation of a proper model may help in enhancing students scientific literacy.

According to the [18] if today’s students want to compete in this global society, they must also be proficient communicators, creative creators, critical thinkers and collaborators which come as the “Four Cs”. Students are not demanded to master only the cognitive part, students are not only demanded to master communicating with others in order to deliver their innovative ideas as they try to solve the problems around them. In order word, students nowadays should be able to develop their cognitive and communication skill.

According to [19] one of learning model which is able to acomodate students to solve any problem in order to enhance their science process skill is problem based learning (PBL), while according to [20] cooperative learning provides three types of learning outcomes such as cooperative behaviour, tolerance of diversity, and academic achievement. In other words cooperative learning, in this case TPS, will stimulate everyone in the class to communicate. To promote scientific literacy and communication skill, it is necessary to examine the suitable learning stategies. Another result [21] shows that problem-based learning may enhance students scientific literacy. Furthermore [22] in his research suggests that combined PBL and TPS may increase students scientific process that contributes to both students’ science literacy and critical thinking. This research aims to implement PBL combined with TPS in order to enhance students' scientific literacy and communication skill.

2. Method
This research is a Lesson Study-Based classroom action research which uses descriptive-qualitative in two cycles. Each cycles is mainly consisted of planning, doing and reflecting. The chosen action in this research is implementing Problem-Based Learning combined with Think Pair Share. This research uses one model teacher, four observers and fifteen students as samples. The samples are college students attending Teaching Biology in English Course. Every cycle in this research consisted of three steps.
including (1) planning (2) acting and (3) reflecting. The first step includes basic competency analyzing, formulizing competency indicator, and constructing instrument to measure students’ scientific literacy and communication skill. In acting step researcher implements the planned strategy. The first cycle was conducted March 6th 2018, while the second cycle was done in April 4th 2018. In this steps observers take a note regarding the accomplishment of implemented model. For observers from this research including two expert observers (lecturers) and two peer observers (college students). In the last step, evaluating the whole process will be conducted in the end of lesson in reflection session.

The first cycle was planned to conduct a lesson using ‘drug addiction’ as the topic. The basic competency formulized in this learning is ‘students are able to identify for a better solution upon drugs addiction’. So to reach that competency teacher try to orient students to the problem related to drugs addiction. The teacher then organized students to study by giving the first instruction to think by theirsself about their social perspective upon drugs addicts. After that teacher asks students to pair up and discuss about the better solution upon drugs addiction. During the activities teacher assists independent and group investigation upon developing a better solution. The following activity is developing and presenting artifact and exhibits which is manifested in presenting groups solution. A number of groups were asked to share idea in front of the class. The last activity is analyzing and evaluate the problem-solving process, where teacher gives encouragement and reinforcement upon students’ solution as problem-solving process. After planning the lesson the research proceeds to the acting steps where teacher implements the lesson. During the acting steps, observers observe the learning activity and take note for reflecting steps. After implementing the plas, reflection was conducted in order to give evaluate the learning activity for the first cycle.

The second cycle was planned to conduct a lesson using ‘mutation’ as the topic. The basic competency formulized in this learning is ‘students are able to serve exploration result about mutational events and humans disorder’. So to reach that competency teacher try to orient students to the problem related to mutational event. The teacher then organized students to study by giving the first instruction to think by theirsself about the given issue regarding mutation. After that teacher asks students to pair up and discuss to have deeper knowledge and able to explain mutation scientifically. During the activities teacher assists independent and group investigation by giving appropriate reference that may help students. The following activity is developing and presenting artifact and exhibits which is manifested in presenting groups solution. A number of groups were asked to share their exploration result in front of the class. The last activity is analyzing and evaluate the problem-solving process, where teacher gives encouragement and reinforcement upon students’ solution as problem-solving process. After planning the lesson the research proceeds to the acting steps where teacher implements the lesson. During the acting steps, observers observe the learning activity and take note for reflecting steps. After implementing the plas, reflection was conducted in order to give evaluate the learning activity for the first cycle.

Data in this research was collected using three instruments such as (1) observation sheet for observers, (2) worksheet with scoring rubric to measure students’ scientific literacy and communication skill. Observer’s observation sheet was used to take note regarding the syntax accomplishment during the whole lesson. Students’ scientific literacy skill was assessed from students’ answer in their worksheet. According to [23] students’ scientific literacy skill consist of three competencies such as explain phenomena scientifically, evaluate and design scientific enquiry and interpret data and evidence scientifically. This research emphasizes on enhancing explaining phenomena scientifically as one of the scientific literacy competencies which was assessed based on three aspects such as (1) scientific identifying and explaining (2) scientific consistency and (3) using scientific knowledge to solve problem. Collected data will be processed using following formula

\[ SS = \frac{\sum \text{collected score}}{\sum \text{maximal score}} \times 100\% \]

Note
Students’ communication skill was also assessed in the same way. Students’ communication skill was assessed based on three aspects such as (1) language usage (2) fluency and (3) clarity. Collected data will be processed using following formula

\[ CS = \frac{\sum \text{collected score}}{\sum \text{maximal score}} \times 100\% \]

Note

\( CS \) : communication skill score

Collected scientific literacy score and communication skill score from every student will be averaged and compared between the first and second cycle to determine the effectiveness of the implemented model.

### 3. Result

This study aims to develop lesson plan, lesson strategy, model, media, or even a set learning materials by doing observation, reflection, and revision, in continuous cycle of learning. In hopes that teachers can improve their strategy, instrument and other lesson aspect.

The observers take a note in every steps of learning which was done by the model teacher. From the observation’s sheet on the first cycle shows that during the learning activity almost every student studied actively. It can be seen that students are engaged to the learning activity since the selected issues are closely-related to students’ daily life. Some students seemed to be confused with the learning activity, which demands students to actively discuss with each other. This kind of situation is noted as a result from the lack of clear instruction during the lesson. There are several pairs which consist of ‘talkless’ students. This unequal pairing was one thing that should be repaired for the next cycle. Expert observers noted that model teacher should try to evaluate students’ acquisition in the end of learning activity. They also suggested to write down learning topic and objectives in the whiteboard that could help student to understand the learning activity.

Data from observation sheet on the second cycle shows that most students had already tried to follow the given learning instruction. It can also be seen that students are also engaged to the learning activity since the selected issues are closely-related to students’ daily life. Some students found difficulties during the learning activity since the learning activity demanded deep understanding of scientific phenomena. Observers noted that other group member help them to understand by using their own sentences. In order to evaluate their understanding, during the end of learning activity every member of each group was invited to share their knowledge in front of the classroom. Expert observers suggested to be wiser in picking learning activity that should be done in limited time.

Scoring rubrics are used to assess students’ scientific literacy and communication skill. Data from the first cycle shows that average scientific literacy skill that includes scientific identifying and explaining, scientific consistency and using scientific knowledge from fifteen students is 50%. While the average communication skill that include language usage, fluency and clarity from fifteen students is 54%. Data collected from the first cycle then becomes the basic evaluation in order to perform a better learning output in the second cycle. The second cycle shows that average scientific literacy skill that includes scientific identifying and explaining, scientific consistency and using scientific knowledge from fifteen students is 79%. While the average communication skill that include language usage, fluency and clarity from fifteen students is 70%. The summary from first and second cycle is shown using diagram I. It can be seen that scientific literacy and communication skill were enhanced as much as 29% and 16% respectively.
4. Discussion

Lesson study is a systematic process which is used by Japanese teachers to test and observe learning activity in order to improve learning itself [24]. Based on the observation sheet, it can be said that most students are interested and engaged to learn about topics which are closely-related to their social life. Even though, proposing an idea and doing exploration related to learning topics are difficult things to be done, teacher’s guidance and the opportunity to work in groups help students to learn, and overall students can enjoy the learning activity. The grouping activity will also help students to solve their difficulties, as explained by [22] that cooperative learning, in this case TPS, may overcome the disadvantage of PBL which demands high cognitive skill from students.

According to the result of observation, it can be analyzed that every student in the class are active. According to [9], students are motivated to solve authentic problems and show the preference for learning activities through a process of thinking and working, rather than just learning by listening. This is indeed has been planned by teachers that chose closely-related issues. Teacher asked students to do exploration from the formalized problem through a literacy activity. This was one of the special features of PBL. The special feature of PBL is that students may develop their thinking through an activity which is demanding students to think for a better solution [20].

[20] states that problem-based learning strives to help students become independent and self-regulated learners, in other hand [8] states that one among other its importance, turning students into self-regulated learners is one of its importance. In other words, PBL facilitates students to enhance their scientific literacy. The first activity in the main learning is that every student is being asked to do exploration in order to answer several guiding questions to solve their main problem. Teacher expected that this activity may develop students critical thinking.

Research from [9] suggests that biological literacy and critical thinking can be developed using appropriate learning strategies or learning models. The teaching strategy that develops the ability of students to read critically, to write ideas, and to discuss is used to increase scientific literacy [25]. Problem-based learning is a student-centered learning model that uses problems as a foundation for learning to solve problems through a series of scientific process skills and scientific thinking skill. Students who learn through problem solving have good knowledge because problem solving foster...
critical thinking and critical triggers the development of knowledges [5]. But, some students complained that they face difficulties during the exploration process because of the limitation of available trusted resources. In this case teacher plays his role as facilitator who facilitates students with prepared learning material.

But, the aim of scientific literacy is not limited to make every student to be a self-regulated learner, but [6] states that science literacy aims on creating a literated society. The transfer of knowledge will not be done if teacher didn’t decide a suitable learning model which allows students to interact each other. In this case teacher uses TPS as one of Cooperative learning model which allows students to do knowledge transfer after several given time to think by their self. TPS as one of cooperative’s type holds several effective learning experiences as suggested [26] such as (1) positive independence when students work together to attain the group objective (2) Individual accountability, when each team member is considered responsible for his or her own understanding of the work, which turn contributes to the objective of team (3) Interpersonal skills (communication, trust, leadership, decision-making and conflict resolution), where team members argue, solve problems, and work together (4) Face to face interaction and (5) Processing, where learners assess and reflect on their team work ability and skills. In other words, using both combined PBL and TPS help students to enhance their scientific literacy.

Beside scientific literacy, it can be seen that combined PBL and TPS also enhance students’ communication skill. This could be occured since in the combined syntax of PBL and TPS allows student to communicate with each other during the learning activity. Research by [27] explains that communication skill is emphasized on students capability to (1) read, write and give meaning on ideas, (2) express and explain their idea upon concepts and their relation, (3) formulize definition and make generalization during investigation, (4) using a proper language or vocabulary to express their idea, (5) understand, give meaning, and evaluate idea which are written, spoken or visualized served and (6) produce or serve argumentation and do persuasion.

In this combined model learning, all of those skills are accomodized. For example, during the Think phase, students are asked to understand given problem and try to solve it by their self. During Pair phase students are able to do communication in order to express and explain their idea. While during the Share phase, students try to produce or serve argument and do persuasion in front of class. During the whole lesson, students are also demanded to use proper language to express their idea. As [22] mentioned that combined PBL and TPS are not limited in enhancing students’ thinking process but also a whole scientific process skill, which include communication skill. In other word, PBL combined with TPS ables to enhance students’ communication skill.

5. Conclusion
The result of this research shows that the implementation of PBL combined with TPS model can enhance students’ scientific literacy and communication skill through its learning activity which is facilitate students to face real closely-related issues and give students chance to share their idea.

6. Suggestion
In order to enhance any students skills, teacher should use a proper learning strategy. Teacher must plan their learning activity better. We should remember that a good learning activity may push our students to be a good learner.

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