

Implementation of Transcript Based Lesson Analysis (TBLA) on Pre-Service Science Teachers' Scientific Literacy and Argumentation Skills

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Abstract. This study aims to analyse pre-service science teachers' scientific literacy and argumentation skills by using the TBLA method in implementing lesson study. This study is a descriptive qualitative research that analyse the communication designs appear in teaching and learning process by using students' scientific literacy and argumentation skills worksheet. The sample was selected using purposive sampling technique. The data were collected using observer field notes and documentation study. The lessons recorded using cameras and camcorders devices were transcribed and analysed using the Excel program based on the number of words expressed by students and lecturer. The frequency of keywords appeared in learning science was fully considered. The data were converted into graphs. The classroom conversations were dominated by the lecturer in the first cycle of lesson study. However, in the second cycle of the lesson study, the communication designs of lecturer-student-student were mostly carried out in the classroom. The lecturer applied a larger student-centered activity pattern as a result of learning reflection and redesign in the first cycle. The results imply that TBLA is an effective method to reflect on teaching implementation and students' learning activities in order to improve teaching and learning process for better instructional practices.

Keywords: TBLA, scientific literacy, argumentation, pre-service science teacher.

1 Introduction

The era of digital technology that has affected the 21st century has had a huge impact on various aspects of life, including in the world of education. One of the real challenges in the field of education in Indonesia is being able to produce human resources who have 21st century competencies. The need of higher and more complex competencies in the 21st century makes the challenges faced by the world of education in Indonesia even more complex. Educational challenges in the future are no longer in the form of knowledge competition but will turn to competition on creativity, collaboration, communication, imagination, and critical

thinking to solve problems [1]. This condition requires new skills to be able to adapt in changing times. Therefore, in developing these skills, school must indeed perform implementation changes in classroom learning.

Changes in the implementation of classroom learning from teacher centered learning (TCL) to student centered learning (SCL) provide opportunities for students to learn independently and learn from friends; teachers guide and facilitate students to solve problems with students' critical thinking skills through collaborative learning in increasing learning motivation, comprehension in knowledge and positive attitudes towards the material being taught [2]. However, what happens in the field is the SCL is only a theory and unconsciously there are still many teachers who have not been able to fully implement it. Students receive more knowledge than build their own knowledge and are less facilitated to be creative, collaborate, argue and communicate among themselves. It indicates that the learning is not effective and the quality of the learning process itself is still low. Student learning outcomes reflect the justification for successful learning until now. Poor learning outcomes indicate ineffective learning [3], [4]. Indonesian student learning outcomes are still far behind by other countries as reflected in the results of the PISA (Program for International Student Assessment) by the Organization for Economic Cooperation and Development (OECD).

Indonesia was at the level 72 out of 77 countries with 70% of participants below the minimum competency for reading, 72 out of 78 countries with 71% of participants below the minimum competency for mathematics, and ranked 70 out of 78 countries with 60% of participants below the minimum competency for science [5]. From the data it can be concluded that learning activities in the classroom have not significantly affected student learning outcomes. Therefore, it is questionable whether the classroom communication has not made students active, has not trained students' argumentation skills, has not constructed effective interaction and communication. It is very important for education practitioners to carry out learning reflection and redesign activities by analyzing teaching and learning practices that they have done in the classroom environment. Lesson analysis is very crucial to be applied as a strategy in analyzing teaching and learning process to find out whether the learning activities have implemented as expected. Moreover, the lesson analysis helps teachers and lecturers to understand about how students learn. In teaching practice, the facts about how students learn become a very important concerned. This can be done through scientific analysis by using transcripts. Learning analysis can be performed from the dialogue among students and students-teachers that occurs during the learning process as a principle for reflecting the learning process itself and as a scientific study of student involvement [6]. This learning analysis method through lesson study is called Transcript Based Lesson Analysis (TBLA) which has become known since 2017 and has been developed by the research team from the University of Nagoya, Japan.

The implementation of TBLA in Indonesia showed that a lot of data related to learning process can be revealed and provided information about trends in the direction of communication, interaction, conversation, and the movement of teachers and students in the classroom [7], [8]. Likewise, researchers assume that the application of TBLA through lesson study is a method that can be used to analyze communication designs in students' argumentation skills and scientific literacy in science learning. Communication skills are needed by the students to communicate the results of their thinking. Therefore, students are required to have competency that can support critical thinking and communication skills in

learning, that is the existence of argumentation skills [9]. Argumentation skills are skills that are needed by a person in compiling an opinion that is supported by evidence and real reasons, with the aim of strengthening his opinion on a matter [10]. According to [11] argumentation skills can train students to express their opinions in the form of arguments, provide evidence based on facts, be able to evaluate and consider information from various sources or references during the investigation process, and then they ultimately can draw conclusions. Argumentation skills have been recognized as important skills to be applied in learning since they allow students to be directly active in creating various ideas and questions through a series of processes as well as in conducting scientific practice and exploration [12], [13]. Argumentation skills are closely related to scientific literacy skills as in their application these two skills require 4C competencies in order to find innovative solutions on real problems in the form of carrying out important activities inherent in the scientific exploration process and can properly convey an argument by thinking critically based on evidence support and logical reasons [14].

Argumentation and scientific literacy skills education that strongly supports the fulfillment of the 21st century 4C competencies must be embedded on students from an early age since both are very necessary in facing the era of digital globalization. The teachers must also have both skills to be able to invest the two skills on students. Therefore, it is very important for pre-service science teachers to master scientific literacy and argumentation skills as student teachers who will graduate and be able to share the effective ways of learning to students at school in the future [15]. Research on the implementation of TBLA through lesson study has been carried out quite a lot, including the research of [16] found that the linear pattern occurred on plant tissue systems which described the learning was getting stronger to achieve learning objectives, the learning category led to SCL and an increase in the quality of conversations between teacher and student. [17] conducted a research on the application of TBLA through lesson study in history learning which explained that the improvement in the quality of learning indicated students' historical thinking skills, the participation of students in discussions increased and the learning community was built from the learning activities applied. Based on the studies discussed, the researchers consider the state of the art for further research that can be carried out is the application of transcript-based lesson analysis on scientific literacy and argumentation skills for pre-service science teachers through lesson study in order to build the quality of learning, especially in the learning community of science education study program.

2 Methodology

The purpose of this study is to analyse the communication designs appear in teaching and learning process by using pre-service science teachers' scientific literacy and argumentation skills worksheet. By studying the communication designs and the causative factors through the TBLA method in implementing lesson study, teachers and lecturers can reflect and redesign a better teaching and learning method to improve science teaching quality. This study applied the descriptive qualitative method. This study was conducted in the science education study program and the sample was selected using purposive sampling technique. There were 30 students as participants in the "Integrated Science" class. The data were collected using observer field notes and documentation study. The lessons recorded using cameras and

camcorders devices were transcribed and analysed using the Excel program based on the number of words expressed by students and lecturer. The frequency of keywords appeared in learning science was fully considered. The data were converted into graphs. The lecturer applied group discussions using students' scientific literacy worksheet on work and energy and students' argumentation skills worksheet on heat and temperature. Students presented the results of group discussions in classroom discussion led by the lecturer.

3 Results and Discussions

Analysis of the science learning process using the TBLA method through the three stages of lesson study for each cycle, namely plan, do and see. The learning was carried out by virtual meeting using Zoom Cloud application. The planning stage (plan) was implemented by the researchers together with the lesson study team to discuss and develop collaboratively lesson design in the form of teaching materials, argumentation and scientific literacy skills worksheets, observation field notes and descriptions of student activities that may occur in class. TBLA was performed in the implementation stage (do), starting from the beginning to the end of virtual learning in accordance with the lesson design made in the planning stage.

The Excel program was used to analyse data that taken from conversation occurred during teaching and learning process. The data were converted into graphs, as depicted in Figure 1 and Figure 2. The X-axis is the conversation index for both lecturer and students (from the beginning to the end of the lesson). The positive Y-axis (upward) is the number of words expressed by the lecturer and the negative Y-axis (downward) is the number of words spoken by the students.

Figure 1 showed mostly upward sharp crests occur in classroom conversation from the beginning to the end of the learning activities in the first cycle of lesson study. There were two the sharpest downward crests and some that were quite sharp crests downward but not as many as moderately sharp crests upward. This described that the classroom conversations were dominated by the lecturer while the students gave responses in short words. On the other hand, in Figure 2, there were more sharp downward crests than sharp upward crests. It indicated that students mostly carried out communication in the classroom. In contrast to Figure 1, where the students gave responses by answering briefly, the conversation depicted in Figure 1 showed that communication between students mainly contained short explanations or answers on student worksheet and lecturer's questions.

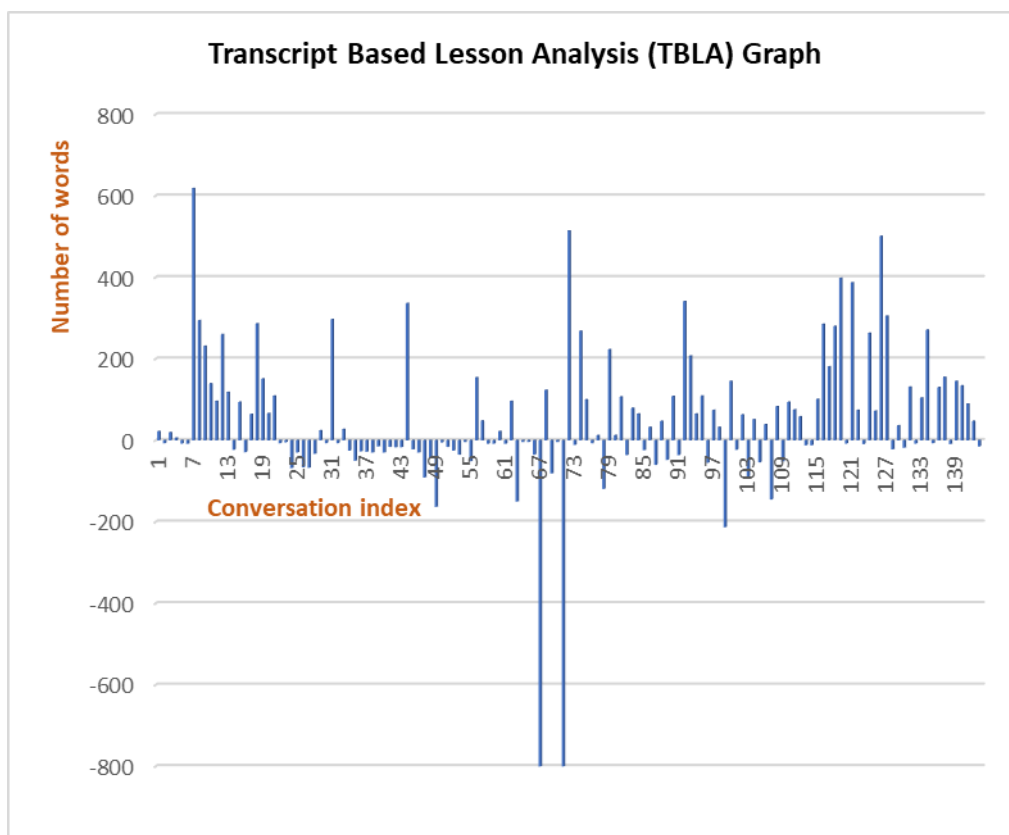


Fig. 1. Lecturer-students speaking frequency on heat and temperature.

The two sharpest downward crests in Figure 1 showed the activities of communicating the results of group discussions on students' argumentation skills worksheet in the topic of heat and temperature by two representative groups. The classroom conversations were dominated by the lecturer in presenting the learning materials from PhET Interactive Simulations at the beginning of the learning activity while explained the topic of group discussion questions on student worksheet. Furthermore, students carried out group discussions to the questions given in the worksheet and two groups presented the results of their group activities in the middle of the lesson. Lecturer provided feedback on group presentations by presenting PowerPoint to explain the concept of heat and temperature while conveyed the correct answers to the questions given in the worksheet. Moreover, the analysis of learning communication designs, in this case the number of words uttered by the lecturer and students was also based on important words' appearance during the teaching and learning process such as question words "what, how and why" and some important science concepts. The appearance of the words "why" which was very few, only 2 times on heat and temperature lesson. On the other hand, the use of the word "what" and "how" was very frequent appeared either written on student worksheet or on lecturer' questions.

Several important science concepts appeared on teacher-student communication designs such as increase or decrease in (temperature, internal, kinetic and potential energy) which represented misconceptions on students' argument. There was communication between students during group work, but the lecturer's role was still powerful when referred from the graph above. Therefore, the communication designs of lecturer-student-lecturer-student were more often carried out by the lecturer than lecturer-student-student communication in the topic of heat and temperature. This communication designs showed that students' argumentation skills were fairly low because the students were still not trained to express what was on their minds and the lack of scientific conceptual understanding about specific topic provided in student worksheet. [18] and [19] stated that communication designs in the classroom are highly dependent on the learning (activities) designs, questions, or feedback, as well as students' conceptual understanding. Students' conceptual understanding of the certain topic is obtained through learning activities that support the development of scientific argumentation skills [20]. This is also supported by [21] which states that when students have a good understanding of the concept, they will be able to develop good scientific argumentation skills as well. Through the understanding of the science concept, students will think logically in writing their arguments.

The TBLA graph in Figure 2 showed that there were more sharp downward crests than sharp upward crests which indicated the communication designs of lecturer-student-student were mostly carried out in the classroom. In the second cycle of lesson study, the lecturer applied a larger student-centered activity pattern as a result of learning reflection and redesign in the first cycle. Lecturer delivered an introduction of work and energy materials, and the students were motivated to carry out literacy activities in studying the materials in the given learning resources (e.g. textbooks, journals, PhET Interactive Simulations) independently. Students were then asked to answer the problems in the students' scientific literacy worksheet with the lecturer's guidance. Through group discussion activities, the students were collaboratively engaged to explain and evaluate scientific phenomena problems based on data and evidence found in scientific enquiry. The use of the words "why" and "how" which was very frequent, appeared either written on student worksheet or on communication designs of student-student during group discussions. Furthermore, the students presented the results of their group discussions in main room. The learning activities with more student-centered, such as collaboration, managing an effective relationship between lecturer-students and students-students [22], enable students to share ideas, convey arguments and reflect on an understanding of the science topic through various ways, both oral and written; these, in turn, make their communication skills better. This also contributed to overcoming students who tend to be passive due to low academic capacity [23].

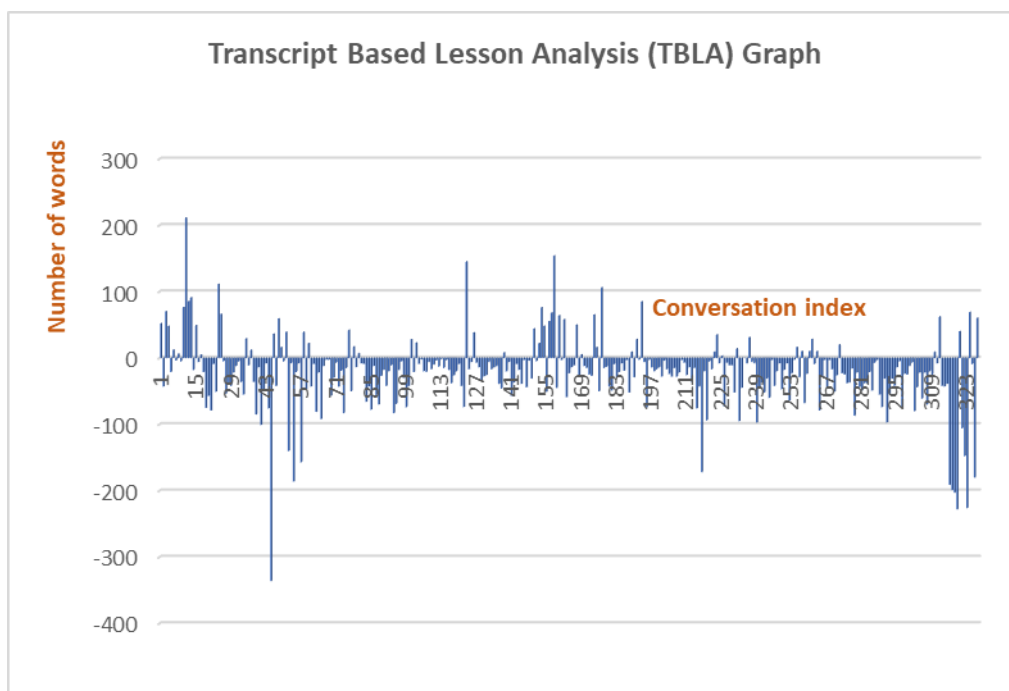


Fig. 2. Lecturer-students speaking frequency on work and energy.

4 Conclusions

The classroom conversations were dominated by the lecturer in the first cycle of lesson study. The communication designs of lecturer-student-lecturer-student were more often carried out by the lecturer while the students gave responses in short words. However, in the second cycle of the lesson study, the communication designs of lecturer-student-student were mainly carried out in the classroom. The lecturer applied a larger student-centered activity pattern as a result of learning reflection and redesign in the first cycle. TBLA is an effective method to reflect on teaching implementation and students' learning activities in order to improve teaching and learning process for better instructional practices. The limitation of this study is not all conversation data in each group by implementing virtual learning can be recorded. Therefore, the transcripts made were only limited to the lecturer-student conversation data that occurred traditionally. It would be more interesting if the group discussion conversations can be recorded and analysed to see a more comprehensive description of the communication designs.

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