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by Atiek Winarti

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Applying Transcript Based Lesson Analysis in Enhancing Communication Pattern between Teacher and Students in Chemistry Classroom

Atiek Winarti*
Universitas Lambung Mangkurat,
INDONESIA

17 Parham Saadi
Universitas Lambung Mangkurat,
INDONESIA

Ismi Rajiani
Universita² Lambung Mangkurat,
INDONESIA

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Abstract: Transcript Based Lesson Analysis (TBLA) is a transcript-based learning analysis method developed at Nagoya University, Japan. This new method is believed to justify the success of instructional design planned by the teacher. So far, the success of learning design has been reflected in student learning outcomes, even though the learning outcome data are not sufficient to provide an overview of the actual classroom conditions. This study aims to analyse the communication patterns in learning Chemistry using the TBLA method. This research is a descriptive qualitative study that analysed the less⁷ of Chemical Bonds and Carbon Atoms Characteristics, which were conducted in two Senior High Schools in South Kalimantan, Indonesia. The data were collected using observation 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 spoken by teachers and students and the frequency of keywords in learning chemistry. The data were transformed into graphs. The results showed that analysis using TBLA provided integrated information about communication patterns and classroom quality. In these two classes, communication pattern occurs in Chemistry learning was teacher-student interaction only. The multi-ways transactions pattern has not occurred. The low quality of teacher questions and the incomplete deep learning phase in learning chemistry caused the expected multi-directional transaction communication has not been conducted. The result implies that TBLA is an effective tool to reflect on teacher practices and improve their teaching process for better instructional practices.

Keywords: Communication pattern, transcript-based lesson analysis, chemistry learning, teacher-student interaction.

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21 Introduction

An essential element of learning activity is communication between teachers and students, as well as interactions that occur both between teacher-students and between fellow students. As a social interaction, understanding learning activities cannot only be from the processes that occur in individual students. Furthermore, it is crucial to understand the social conditioning that involves other people, both teachers and fellow students. Therefore, this context includes their communication, the cultural context in which they are located, and the actions they take (Bransford et al., 2006; Rogoff, 1998). Thus, teachers' vital task in creating quality learning is to develop positive patterns of communication and interaction and create a learning atmosphere that motivates students to be active. One of these is to provide quality questions, and feedback to encourage students to answer, argue or ask questions (Biggers, 2018; Matra, 2014). Teacher questions and input in science learning contribute to making learning dialogue; therefore, the learning process feels more meaningful (Jacques et al, 2020; Janah et al., 2019).

The problem is that teachers often find it difficult to justify whether the learning design they implement has created significant patterns of interaction and communication. Observed from the poor learning outcomes of students in Indonesia as illustrated in both the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) data, where at the 2018 PISA Indonesia was at the level 72 out of 78 countries or in the 2011 TIMSS it was at the level 38 out of 42 countries. From this data, it can be concluded that teachers' learning activities have not significantly affected student learning outcomes. From this data, it is questionable whether the classroom communication has not made students active, has not trained students' thinking skills, has not

* Corresponding author:

Atiek Winarti, Universitas Lambung Mangkurat, Chemistry Education Study Program, Kalimantan Selatan 70123, Indonesia.
✉ atiekwin_kimia@ulm.ac.id

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resulted in effective interaction and communication. Therefore, teachers are still dominated, and they have not involved students (Amin et al., 2020).

To deal with this problem, teachers need to reflect on their teaching practices in the classroom. Until now, the justification for successful learning is reflected in student learning outcomes. Meanwhile, poor learning outcomes can indicate ineffective learning being carried out (Doménech-Betoret et al., 2019; Donker et al., 2014). Therefore, it is difficult for teachers to use other methods that are more accurate in justifying their learning success except utilising the achievement of learning outcomes indicators or peer teacher opinions.

In contrast to both methods, lesson analysis is a way to analyse learning to determine whether the learning activities are carried out as expected. Furthermore, lesson analysis helps educational practitioners to learn about how students learn. In practice, the facts about how they learn have become a very considerate focus. This is carried out through scientific analysis using a transcript; therefore, learning analysis is conducted through opinions such as reflections usually performed and the scientific study of the student involvement. This method is called Transcript-Based Lesson Analysis (TBLA), which has become known since 2017, and has been developed by the research teams from the University of Nagoya, Japan.

The implementation of TBLA in Indonesia showed that TBLA could reveal a lot of related data about learning. This implementation can provide information about trends in the direction of communication, interaction, conversation, and teacher movements in the classroom (Arani, 2017; Arani et al., 2019; Janah et al., 2019).

Based on the above explanation, there will be a study on the interaction patterns and communication in Chemistry lessons designed by several high school teachers in South of Kalimantan, Indonesia. The communication in learning is recorded and outlined in transcript form. Furthermore, the analysis is carried out using the Transcript Based Lesson Analysis (TBLA) method to determine how learning tendency and communication interaction patterns are built from the learning design planned by the teachers. The implementation of TBLA will be a new method in analysing the effectiveness of learning designs (Arani et al., 2019; Janah et al., 2019). If many learning variables can be revealed through TBLA, in the future, this technique can be used as a new method to identify the success of learning design. This study will analyze the interaction pattern of teacher-student in learning Chemistry in different subject matter and schools. The discovery of this interaction pattern will be the basis for designing more effective learning designs

Literature Review

Learning is a social activity in which teachers and students interact to make class activities meaningful (Lave & Wenger, 1991). In this interaction, student participation in learning is the main focus. The way teachers and students interact with each other are very important. Good interaction patterns in the classroom will determine students' ability to understand the subject matter (Loef Frank et al., 2007).

The communication patterns and interaction between teachers and students in teaching and learning activities can be divided into communication as an action, communication as an interaction, and communication as a transaction (Barnlund, 1970; Schramm, 1997). Firstly, in communication as action, or one-way communication, the teacher plays a leading role in the learning process. This kind of communication takes place in teacher-dominated classrooms, where students only listen. In this way of communicating, students are not allowed to respond. This communication pattern, for example, occurs when the teacher is lecturing or explaining a lesson, like telling a story.

Second, communication as interaction is also known as two-way communication. In contrast to the communication pattern as an action, in the communication pattern of interaction, the teacher acts both as a subject who takes action and as an object of the action's recipient. Compared to communication as an action, communication as interaction is considered more effective. In this communication pattern, the teacher provides feedback so he/she can understand their students quickly (Schramm, 1997).

Third, communication as a transaction occurs as a result of multi-way communication. For example, students immediately provide a response when the teacher explains. In addition to students communicating with teachers, there is also communication between students. Through this pattern, students learn actively with other students (Barnlund, 1970).

Based on teaching and learning experience, Kanuka (2010) differentiates between teacher-centered and student-centered learning. In teacher-centered interaction, the teacher plays an active role in the teaching and learning process. The communication between teacher and students occurs one way, and students are only listening to the teacher's explanation. In contrast to communication patterns as action, in teacher-centered interactions, students are still allowed to respond.

In student-centered interaction, students play an active role while the teacher acts more as a facilitator. The teacher only helps students understand the material without explaining the subject matter directly, students learn in groups, and the teacher's material is discussed with other students (Wright, 2011).

Methodology

Research Goal

This study aims to analyse the communication patterns in learning Chemistry using the Transcripts Based Lesson Analysis (TBLA) method. By studying the communication patterns and the causative factors, teachers can design a better teaching method to improve teaching chemistry quality.

Sample and Data Collection

This study applied the descriptive qualitative method. In this study, the data was taken from the 2 (two) chemistry learning activities about Chemical Bonds and Carbon Atoms Characteristics which were conducted in 2 (two) Senior High Schools in South Kalimantan, Indonesia. These two schools are both favorite public schools in urban areas but they come from different districts/municipalities in South Kalimantan. The data was collected through observation and documentation using cameras, camcorders, and voice recording.

There were 30 students becoming participants in the "Chemical Bonds" class, while in the class of "Carbon Atom Characteristics," there were 32 students involved. Both classes were taught by different female teachers who have an undergraduate education background. Basically, these two classes applied the same strategy, namely group discussion. But the teachers provide different treatments in each class. In the "Characteristic Carbon Atoms" class, the teacher applied group discussions using videos to motivate students to discuss. Students then take turns presenting the results of group discussions in class discussions led by the teacher. On the other hand, in the "Chemical Bonds" class and implementing group discussions, the teacher assigns students to make poetry, short stories, or short dialogues related to chemical bonds at the end of the lesson. At the end of the learning assessment teacher applied Kahoot!

Analyzing of Data

The learning observation data in the forms of student-teacher conversation and notes about learning events were converted into transcripts and analysed using Transcript Based Lesson Analysis (TBLA) method. Based on the transcripts, the data was quantitatively and qualitatively analysed. By using Excel Program, the transcript was analysed based on (1) the number of words spoken by teacher and students with the unit analysis is the students in three groups of students, and (2) the frequency of important keywords appearance, such as question words "what, how and why" and some important chemistry concepts. Several important chemistry concepts are selected from the subject matter that has been planned in the lesson plan. Through the Excell program, these words are calculated then they were transformed into graphs and diagrams. The data are then qualitatively analysed by relating them to other findings to explain how students build knowledge, how teachers build interaction, and how teachers develop communication skills.

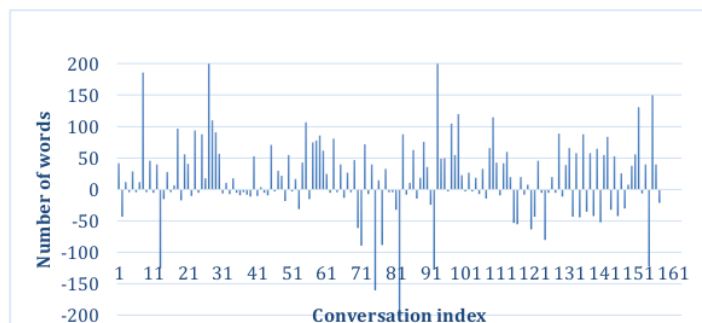
Findings / Results

Analysis of Communication Patterns Based on the Number of Words spoken by Teachers and Students

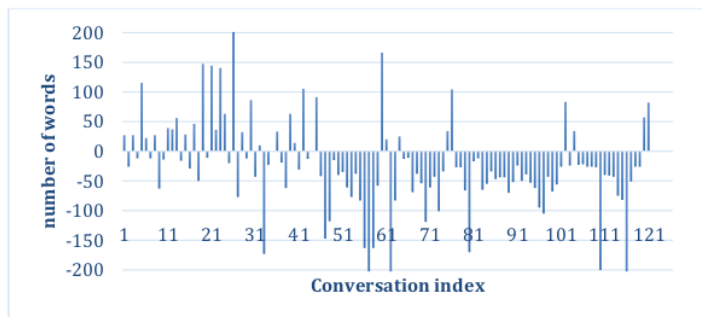
Analysis of the teachers' and students' conversation transcripts in the classroom using the TBLA method and several analysis parameters showed illustrative information that characterizes classroom communication patterns using important Chemistry material concepts. Furthermore, the analysis parameters were the "number of words" and "the appearance frequency of important words" during the learning process.

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Data analysis using the Excel program produced a graph, as shown in Figure 1. The X-axis (horizontal) is the conversation index for both teacher and students (from the beginning to the end of the lesson), and the positive Y (vertical) axis (upward) is the number of words uttered by the teachers. Besides, the negative Y-axis (down) is the number of words spoken by the students.



(a) Teacher – Students Speaking Frequency in Characteristics of Carbon Atom Lesson



(b) Teacher – Students Speaking Frequency in Chemical Bonds Lesson

Figure 1. The Comparative of Teacher-Student Speaking Frequency in Chemistry Lesson

Figure 1 (a) shows mostly upward sharp peaks, followed by blunt downward peaks. There are some sharp downward peaks but not as many as sharp peaks upward. This indicates that the class conversation is interactive, but the teacher dominated the conversation while the students only answered in short words. On the other hand, in Figure 1 (b), there are more sharp downward peaks than sharp upward peaks. It means that students mostly carry out communication in the classroom. In contrast to Figure 1 (a), where students communicate briefly, the conversation depicted in Figure 1 (b) shows that communication between students mostly contains explanations, especially from the middle to the end of the lesson.

This finding was also supported by the part of conversation transcript between teacher and students, which was shown in Table 1 and 2 below.

Table 1. The short conversation of students-teacher dialogue in "Carbon Atom Characteristics" class

Index	Speaker	Conversation
13	Conversation 1	
45	Teacher	Okay, starting with the factory smoke. Does anyone remember the compound?
46	Student:	CO ₂
47	Teacher	Of the five compounds, are there similarities or not?
48	Student	Yes
49	Teacher	What are the similarities?
50	Student	all of them have Carbon atoms
11	Conversation 2	
99	Teacher	So, carbon compounds can make single bonding and double bonding. The double bonding can be double and triple bonding. CN asked how many electrons?
100	Students	Two
101	Teacher	It means how much less?
102	Student	Two
103	Teacher	It means that the compound hasbonding
104	Student	Single
105	Teacher	If the line is two, what is the bond?
106	Students	Double bonding

Table 2. The communication among students in "Chemical Bonds" class

Index	Speaker	Conversation
104	Teacher	Come on, your group will go forward.
105	Student 1	So, here we will show you our work; the story begins with a housing complex called the periodic line. There are four elements discussed. Helita, Magneki, Oksiza, and me as a Bromit.
106	Student 2	Hello, can you know where I am?
107	Student 3	Oh yeah, here is the oxygen complex.
108	Student 2	Hi Helita, I want to meet those who are in that noble gas class.
109	Student 3	Some so many people own electricity according to the duplet rule.
110	Student 2	By the way, you know that you have a stable bond. Because there used to be a history that you fought, magnesium will bind 2 2 electrons and bind magnesium and oxygen. While Helita comes from a noble gas family, hence gets the duplet rule. So, it stabilised instantly. This is different because you can bond; therefore, you can be a compound if you have a bond.

Table 1 shows the short communication between teacher and students due to the low level of teacher question in the "Carbon Atom Characteristic" class. In contrast, Table 2 shows the longer conversation among students in the "Atomic Bonds" class.

Analysis of Communication Patterns Based on the Appearance of Important Words spoken by Teachers and Students

In addition to the number of words spoken by the teacher and students, the analysis of learning communication patterns was also based on important words' appearance during the learning process. The two-way interaction in the classroom, which allegedly occurred because the teacher's questions were still at the Lower Order Thinking (LOT) level, was also strengthened by the analysis results for the appearance of keywords which did not find any questions that led to Higher Order Thinking (HOT).

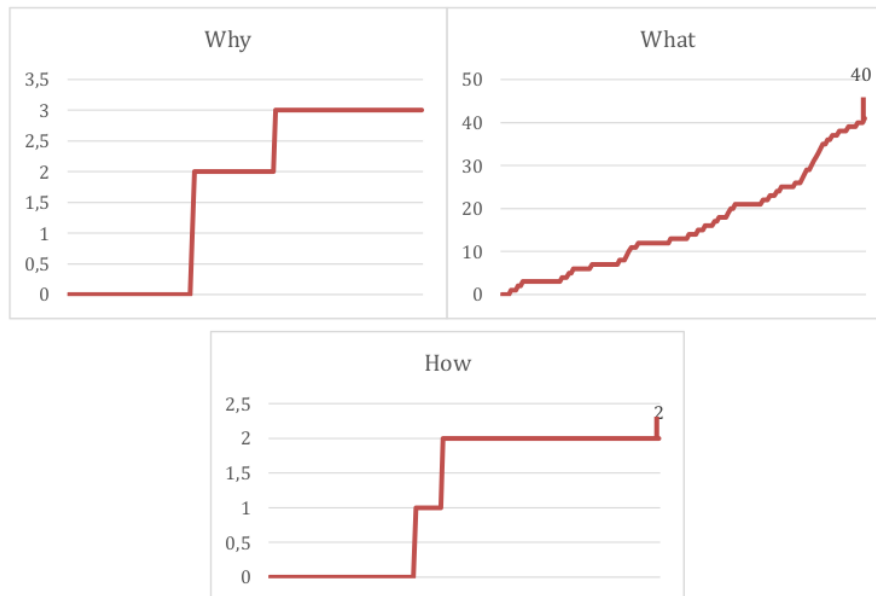


Figure 2. The frequency of using "Why, What, How" keywords in the "Characteristics of Carbon Atoms" lesson

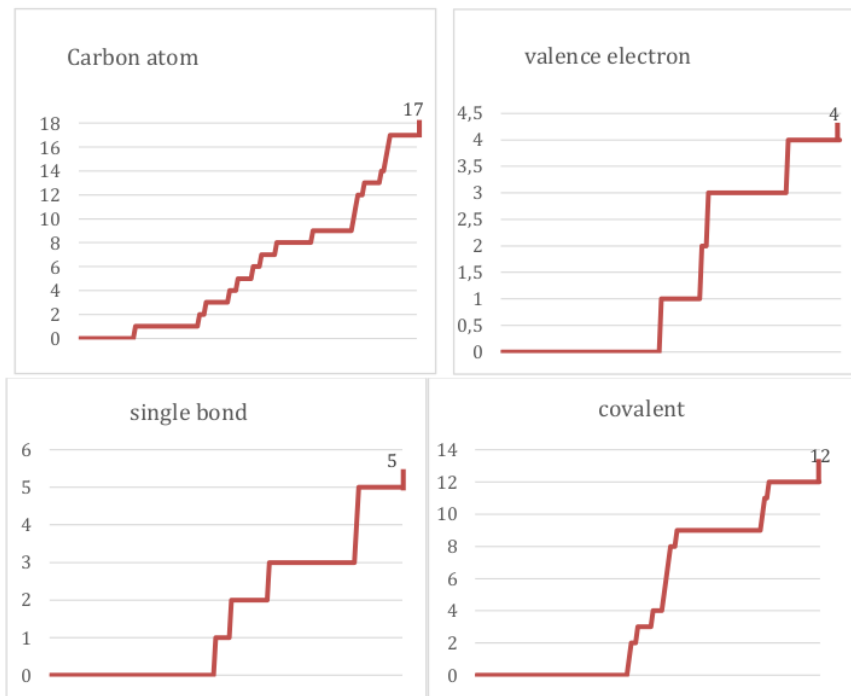


Figure 3. Analysis of the frequency of using important words in "Characteristics of Carbon Atoms" lesson

However, based on the appearance cumulative frequency of the words "why," "how," and "what" in Figure 2, it can be concluded that the important concepts conveyed during learning are mostly in the form of presentations by teachers.

The same thing happened to the learning material "Chemical Bonds." The analysis results for the cumulative frequency of using words that motivate students' critical thinking, such as the words "why" and "how" are as follows.

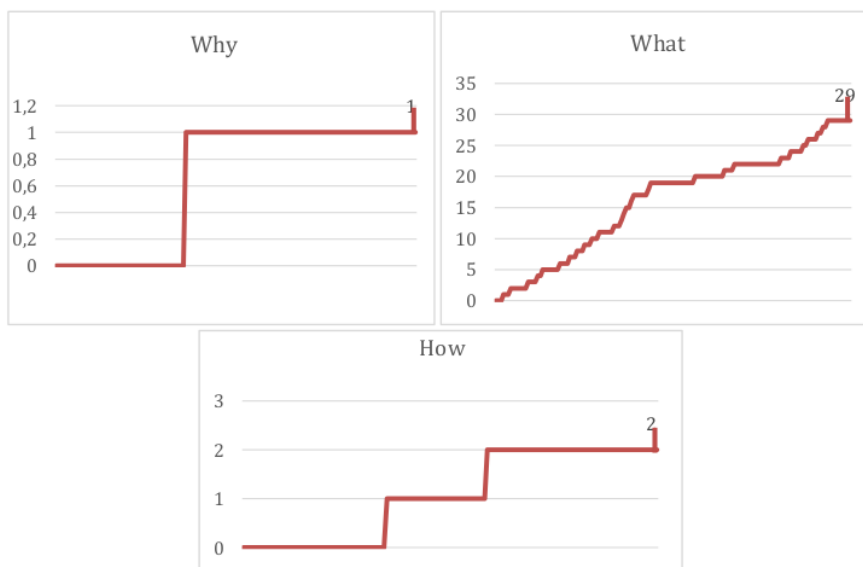


Figure 4. Analysis of the frequency of using the keyword "Why, What, How" in the "Chemical Bonds" lesson

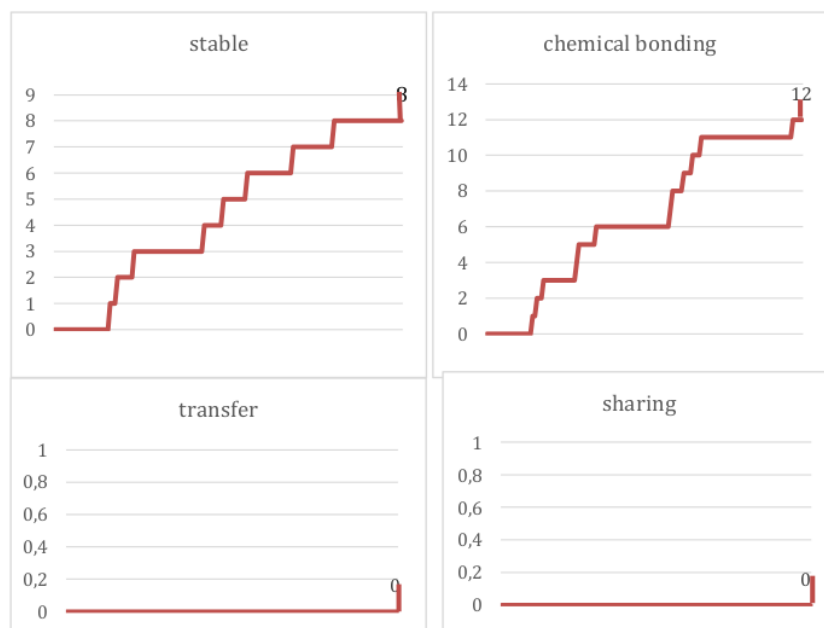


Figure 5. Analysis of the frequency in using important words at the "Chemical Bonds" lesson

Figure 2 and Figure 4 show the same trend in both classes, namely the appearance of the words "why" and "how" which is very few, only 2 to 3 times in the "Characteristic Carbon Atoms" lesson, and 1 to 2 times in "Chemical Bonds" class. On the other hand, the use of the word "what" is very frequent, namely 40 times in learning "Characteristic Carbon Atoms" and 29 times in learning "Chemical Bonds."

Figure 3 shows that the important concepts expected to appear in the conversation are in accordance with what was planned in the lesson plan. However, in Figure 5, there are two important terms related to chemical bonding, namely "sharing" and "transfer" which in the lesson plan are expected to appear, but in fact, do not appear in conversations either by teachers or students.

Discussion

1

Analysis of Communication Patterns Based on the Number of Words Spoken by Teachers and Students

In Fig 1 (a), with the "Characteristics of carbon atoms" learning, there are more sharp upward peaks followed by small downward peaks. This showed that teachers dominate the conversation in class than students. Even though there is domination, interactive communication still exists between teachers and students. Furthermore, the students respond to questions with short answers.

In Fig 1 (b), with the "Chemical Bonds" learning, the sharp downward peaks are more than the upward peaks in the last two-thirds of the lesson. This showed the opposite phenomenon that students are more active in speaking in this class. Also, communication in the last two-thirds is dominated by students.

Based on the learning design used, in class (a) who studied "Characteristics of carbon atoms," the teacher applied teacher-centered learning, while in class (b) who studied "chemical bonding," the teachers used student-centered learning. While applying teacher-centered learning in class (a), the teacher used the group discussions method. In the first half (minute 1 to minute 70), after showing the video, the teacher conducted a question and answered session with students to deliver their understanding of the concepts to be studied. The question given by the teacher before students work on the worksheet was :

Teacher: Why can this carbon atom bond with other atoms? (index 57)

Furthermore, students discuss the questions given in the worksheet. In the last half of the lesson, each group presented the results of their group activities. Therefore, this classroom's learning pattern used teacher-centered in the first half of the lesson, then student-centered in the last half.

In contrast, in class (b), who studied "Chemical Bonds" material, the teacher applied a larger student-centered activity pattern. In the first third of learning, an introduction was provided, and the students were motivated to learn the material in the textbook independently. Students were then asked to answer the problems in the worksheet with the teacher's guidance. Also, in one-third of lesson time, two students visualised their understanding of the concept by making poetry or a short dialogue related to the subject matter. Furthermore, the students presented the results of their discussion in class. Finally, in the remaining time, the teacher conducted an evaluation using exciting applications such as Kahoot! In this session, the activity was substantial, and there was quite intense communication between fellow students.

In these two classes, there were dominant differences in terms of communication. In class (a), the teacher's communication dominance was more remarkable, while students dominated class (b). However, the interactions created through the teacher-student-teacher communication patterns in the two lessons tend to be the same. The two classes adhered to a two-way interaction communication pattern in the core activity and not multi-directional. In other words, the communication was between teacher-student-teacher-student. There was communication between students during group work, but the teacher's role was still dominant when seen from the graph above. In class (b), even though the communication was dominated by students in the second half of learning, it was still two-way. Based on the transcript contents, students have not actively responded to their peer comments or presentations. This showed that the communication management patterns that chemistry teachers usually implement in class are mostly interactive (two-way). Therefore, *teacher-student-teacher-student* communication patterns are more often carried out by teachers than *teacher-student-student* communication.

Some previous results showed that communication patterns in the classroom are highly dependent on the learning design, questions, or feedback, as well as students' academic abilities (Chin, 2007; Gage et al., 2018; Hanrahan, 2006; Jacques et al., 2020; Lee & Irving, 2018; Pimentel & McNeill, 2016). Meanwhile, learning designs with more student-centered, such as collaboration, managing an effective relationship between teacher-students and students-students (Bature & Atweh, 2019), enable students to share ideas, convey reasons and reflect on an understanding of the subject matter through various strategies, 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 abilities (Van der Veen et al., 2017; Weasel, 2017). The difference in learning designs applied by the teachers in the two classes seemed to have contributed to the differences in communication patterns.

In a class with a larger student-centered pattern, the communication was more dominated by students, while in a class with a smaller student-centered pattern, the opposite happened. In a student-centered learning pattern, as was carried out in class (b), interactions occur between teacher-students and students. Unfortunately, the students' communication was not initiated by the teacher's questions or the students' questions. Also, the teacher does not allow students to formulate their curiosity through questions, even though giving questions directly without allowing them to ask can affect the development of their critical thinking skills (Biggers, 2018; Vale, 2013). This kind of dialogue can be seen in Table 2.

Through this dialogue, students try to represent their basic concepts understanding of Chemical Science. "*There are four elements in the discussion, which are Helita, Magneki, Oksiza, and me as Bromit.*" This showed that students actually want to explain the process of chemical bonding. The four elements, which are He, Br, Mg, and O, have a specific purpose. For example, Mg and O's choice, which both have two valences, was intended to indicate chemical bonds' occurrence through the transfer of electron pairs. Furthermore, as a noble gas element, the selection of He showed the stability concept as the goal of chemical bonds. Besides, Br with one valence's choice showed a difference in valence with Mg and O elements and two valences.

Different from class (b), the teacher in class (a) tried to build students' curiosity through the following conversation:

Teacher: This carbon element can bond with many other atoms. Do you have any questions? (index 55)

Student: Yes, how could it be, Mam? (index 56)

Teacher: So, why can this carbon atom bond with other atoms? Please look for it in your Student Worksheets. (index 57)

But unfortunately, at the end of the lesson, there was no feedback to answer students' questions. As long as there is feedback at the end of the lesson based on the students' findings, their critical thinking skills will develop better (Biggers, 2018; Chin, 2007; Jacques et al., 2020).

Furthermore, the TBLA analysis results in Fig 1 (a) showed an exciting finding for the quality of teacher questions. In class (a) from 1 to 70 mins, the sharp upward peak can be seen, followed by a less sharp downward rise, indicating dialogue between the teacher and students. The dialogue is in the form of questions from the teacher, which students shortly answer as the dialogue revealed in Table 1 and the conversation example below.

In class (b):

Teacher: It' is a chemical bond. This is a metal group, and this is a non-metal group, for example, Li. Come on, what else besides Li (index 42)

Student: Na (index 43)

The types of questions presented by the teacher in both classes are still at the low order thinking (LOT) level, namely "remembering" and "understanding." Furthermore, the questions are more likely to be authoritative, where there is only one correct answer, as in the following class (b) conversation:

Teacher: Carbon atoms can form bonds. So, the bond is....bond? (index 86)

Student: covalent (index 87)

Authoritative-oriented questions can limit students' opportunities to demonstrate high-level scientific understanding. Conversely, dialogic-oriented questions often provide students with discursive space to demonstrate broader and deeper knowledge (Chin, 2007; Zhang & Patrick, 2012). Therefore, in the above case, students' short answers were influenced by more authoritative questions from the teacher. The interaction pattern that occurred in the classroom is also a two-way interaction between teachers and students. Also, there was no visible multi-way interaction involving many students' responses to the questions which the teacher built in this lesson.

This short response can be improved when the teacher changes the type of question to be more dialogic. Therefore, it does not only provoke students to give longer answers but also encourage responses from other students, for example, by changing the questions as follows:

Teacher: Carbon atoms can form bonds. If the total valence electrons of the carbon atom are 4, how do the carbon atoms bond?

Student: Sharing an electron pair

Teacher: Why share? Not electron transfer?

Student: because of...

Teacher: any other answer?

Student: because...

Through questions like this, the interaction pattern is no longer two-way but can be multi-way.

Analysis of Communication Patterns Based on the Appearance of Important Words spoken by Teachers and Students

Based on important words spoken by teacher and students drawn in Fig 2, it can be seen that in the Characteristics of Carbon Atom lesson, the questions that provoke opinions such as "how" and "why" which motivates students' higher-order thinking skills, only appears three times. The question "why" was asked twice by the teacher and once by the students. This conversation occurs at the conversation index number 55-57.

Conversely, the question "what" was often asked by the teacher throughout the lesson from the first to the last minute. This is what caused the students' answers to be concise. Furthermore, observations during the learning process and data from several research results showed that in science class, questioning is the most important activity (Biggers, 2018; Zhang & Patrick, 2012). However, not all teacher questions can motivate students to conduct scientific investigations. The types of questions the teachers often ask were mostly at the "remembering" and "understanding" level or were still at the LOT level. Furthermore, more questions were asked by teachers, not by students (Biggers, 2018; Matra, 2014; Zhang & Patrick, 2012).

The teacher's questioning skill is a fundamental problem in this study. As long as the question is only at the lower order thinking level, the teacher will have difficulty evaluating students' achievement, and their thinking skills will not develop. However, when the questions are more inquiry-based, communication between students can be more intensive, and their critical thinking skills can be more developed (Biggers, 2018; Matra, 2014; Taat et al., 2020).

The appearance of other keywords related to essential concepts in learning about "Characteristics of Carbon Atom" is different as in Figure 3. Transcript analysis using TBLA with key concept parameters in the communication process in class showed that "carbon atom. often appear 17 times and dominated the conversation. Other concepts such as "valence electrons," which are the primary explanation for carbon atoms' characteristics, rarely appear only about five times during learning, the same as the "single bond" concept. Also, the idea of "covalent" appears more often, about 12 times, during learning. The appearance of the words "carbon atom" and "covalent" alternately spoken by the students with high frequency was already by expectations. Therefore, based on the discussion, the important concepts related to the matter "Characteristics of Carbon Atoms" are sufficient.

Similarly, in the lesson of "Chemical Bonds," the question "why" appeared only once during the lesson, and the question "how" appeared only twice. Meanwhile, the question "what" repeatedly appeared during learning. Interestingly, the question "why" arose from students due to the problem formulation stage activity presented to the class at the discussion stage.

Student: How do chemical bonds occur? (index 51)

Student: Why are the bonds in hydrofluoric acid called a covalent bond? (index 52)

Student: Life is how chemical bonds are (index 85, chemical poetry)

This question was then answered by the group of students themselves as follows

Student: Hydrofluoric acid is a covalent compound because the formation process involves sharing an electron pair. (index 58)

When answered correctly, student questions categorised as higher-order thinking can be developed into exciting discussion materials initiating the inquiry process (Vale, 2013). Unfortunately, the teacher does not use this question to provoke other students' answers to create multi-way interactions. Also, the questions asked by students in the learning process are indicators of a good lesson. Therefore, successful teaching is indicated by the students' performance and questioning activities during the teaching and learning process (Brown, 1976; Hammer, 2001; Zhang & Patrick, 2012).

Furthermore, when the group finished the discussion, no feedback was carried out to check the group's explanation after carrying out the presentation; therefore, the questions "why" did not develop into a source of the inquiry process and critical thinking development. A student-centered pattern like this allows providing feedback used by the teacher to make students perform deep learning. For example, feedback is completed by content development, namely reviewing the answers from each group while the teacher carries out multi-way interactions by involving many other students.

Furthermore, after the conclusion was obtained, students were asked to rewrite the correct answers in their respective notebooks as part of deep learning (Chotitham et al., 2014). However, because there was no particular time provided to carry out these deep learning activities, the actual understanding formed through group activities seemed not to receive adequate feedback, even though delivering feedback can have a positive effect on student learning success (Hattie, 2009; Mapplebeck & Dunlop, 2019).

Aside from the quality of the questions, using the TBLA method also identified the appearance of words as an important concept in the "Chemical bonding" material, namely the words "stable," "chemical bond," "transfer," and "sharing" as provided in Figure 5. Fig 5 shows that important terms such as "chemical bond" and "stable" were spoken by the teacher and students throughout the lesson. Furthermore, the term "stable" became very important because in describing chemical bonds' appearance, achieving stability is the primary goal of each bonding element. Most elements require to achieve stability by combining with other elements to form stable molecules or compounds. The attraction between atoms causing chemical compounds to unite is called a chemical bond. A further explanation is that the bonds between elements to achieve stability happens through the transfer or sharing of electron pairs.

However, when these last two terms were analysed, "transfer" and "sharing" did not appear during the lesson. Seems, neither teachers nor students have touched on this concept. One of the reasons may be that this lesson is only an introduction to the chemical bonding concept, therefore, it was not discussed.

Teacher: Today we will learn about stable electron configurations, the role of valence electrons in chemical bonds and Lewis structures." (index 23)

Meanwhile, in the discussion of chemical bonding, these concepts can be introduced or discussed together and become exciting questions, such as:

Teacher: How do the valence electrons atoms interact to form bonds?

The expected student's answers are:

Students: Atoms form bonds by sharing pairs of valence electrons, or

Students: Through the transfer of valence electrons from each of the bonded atoms

Since this question did not arise, the discussion regarding the concepts of "electron transfer" and "sharing of electron pairs" did not take place.

From Figure 2 and Figure 4, in these two lessons, the developed communication pattern is an interaction (two-way communication), which means that the teacher and students play the same role, namely the giver and recipient of the action. Furthermore, the students responded to questions from the teacher and vice versa. However, because the question types are still at the LOT level, it does not provoke other students to answer. Therefore, communication as a transaction (multi-way communication) does not occur in these two classes. In the class, students are active, but the

motivation to find concepts independently is not developed. In fact, many studies have shown that problem-solving learning involving higher-order thinking skill level can improve students' critical thinking (Amin et al., 2020)

Based on the student learning activities, the teachers are applying more dialogical than deep learning. In the second lesson, the teacher used independent learning when asking students to do works-related concepts such as stories and poetry. It would be better when students were asked to work independently before collaborating, such as reading and designing their work before being discussed with a group of friends.

Dialogical learning shows how students interact with other people, both with teachers and peers. In this learning, enriching the students' insights can be carried out from interactions to form mindsets. It will be more effective when the teacher prepares materials and opportunities to be discussed by students. For example, by providing opportunities for students to discuss the experimental results, they got in the group or solved problems. Meanwhile, deep learning had not been carried out in these two lessons. Therefore, it can be performed by providing students opportunities to present their logic of thinking and reflect on what they have understood.

In this study, many parameters were analysed using TBLA to ascertain the learning design in increasing student activity. Furthermore, the graph produced from the learning analysis method using the Transcripts Based Lesson (TBLA) allows many parameters to be used in studying learning events and a basis for its improvement (Garrison et al., 2006). Transcript analysis is an important method for studying classroom learning, both online and offline (Van Booven, 2015). Transcription and recording systems using video and camcorders allow TBLA to be a solution when direct observation of learning in the classroom is not possible due to various factors, such as schools in remote areas or the pandemic currently happening. Communication in learning, both synchronous and asynchronous, can be transcribed, and data are analysed using the TBLA method.

3

Conclusion

Transcript Based Lesson Analysis (TBLA) can be utilised to reflect the instructional act of the instructor. Analysis of learning activities using TBLA provides information about communication patterns in the classroom. Furthermore, it can provide an integrated overview of the learning quality applied by the teacher. Various parameters, such as the number of words and the frequency of keyword use, complement each other in analysing the learning design success in a more real way. Teacher questioning, input, and students' responses can be interpreted to uncover classroom discussion inclination, whether authoritative or dialogic, and discover the lesson gap from the goal.

The teacher developed the teacher-student interaction pattern in large classes and students in cooperative groups. Unfortunately, this activity was not directed and developed by the teacher into a multi-way communication pattern connecting teacher-student-students in a discussion that results in a deep understanding of the concept. Also, the quality of teachers' questions in initiating the discussion is why the expected class discussions do not happen, and students cannot think deeply. Furthermore, questions at the Low Order Thinking (LOT) level that dominated communication between teachers and students affected interaction in the classroom, and students' critical thinking skills do not develop. The frequent LOT level questions and the lack of HOT questions led to short teacher-student conversations and no in-depth discussions.

An essential finding of this research is that the quality of classroom learning can be improved by creating a multi-way communication pattern through questions at the HOT level. Also, dialogical learning activities alone are not enough to make students effectively understand the concept. Therefore, they have to be allowed to go through independent and deep learning phases. Through this research, instructors can use TBLA to reflect on their practices and know how to improve their learning process for better instructional practices.

Recommendations

Instructors can implement the TBLA method to analyze the quality of learning in a more scientific and integrated manner and creating an effective and multi-directional interaction pattern in classroom. In communicating with students during the learning process, teachers advised tasking the higher-order thinking questions to apply student-centered learning and providing more opportunities for students to develop their critical thinking skills through independent and deep learning. The TBLA method can be created for use in the classroom to determine lesson plan implementation quality. Reflection on learning can be carried out by the teacher based on the results of the TBL together with student learning outcomes to determine the success of learning objectives and follow-up efforts to improve the quality of learning

Limitations

In this study, not all conversation data in class can be recorded, especially conversations in each group. Therefore, the transcripts made were only limited to the teacher-student conversation data that happen classically. It would be more interesting if the group discussion conversation can be recorded and analysed to see a more comprehensive picture of the communication patterns.

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