An exploration of talk in secondary chemistry classroom implementing the curriculum 2013 in Indonesia

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Abstract. This study investigates the classroom talk occur during chemistry classroom at Madrasah Aliyah. The focus is on the pattern of classroom talk and pedagogical intervention adapted in chemistry lessons that have implemented the new curriculum, often known as Curriculum 2013 in Indonesia. An exploratory case study approach utilised for this research. The study carried out at one Madrasah Aliyah in greater Jakarta. The chemistry lessons in this classroom were observed over the period of three months. The whole class talk that took place during the target lesson were recorded using video recorder, audio recorder and field notes. The data from classroom observation were analysed using thematic analysis. The finding indicates that the pattern of classroom talk mostly adopted traditional triadic movement (Initiation Response Feedback/IRF). In term of pedagogical intervention, the study shows that the teacher employs various techniques to promote talk: direct elicitation, cued elicitation, developing the conceptual line, and literal recap in which the authoritative discourse mostly took place. The study concludes with the implications for the development of teaching practices that promote classroom talk in science education.

1. Introduction
In July 2013, the Indonesian Ministry of Education and Culture (MEC) implemented a new integrated-thematic curriculum called the Curriculum 2013. There were several reasons why the government changed the curriculum. Firstly, the previous curriculum was more focus on the cognitive aspects and the activities developed in the classroom were not challenging for students. Secondly, Indonesia needs a generation with an entrepreneurial spirit, who are creative, resilient and independent, to support Indonesian economic growth. Finally, the education of character should be integrated in the curriculum to help students develop their excellent character [1].

There was a major change in the curriculum 2013. In the new curriculum, the government integrated religious values, living values and language in every subject taught in schools, including in science education. The Ministry of Education expects that the integration of religious and living values in the curriculum will help students in developing their noble characters so they will be able to cure social and moral problems, such as corruption and violence. And, by integrating language skills in science education, the government hopes that the Indonesian students’ performance will improve in PISA (Program for International Student Assessment) and TIMMS (Trends in International Mathematics and Science Study). The results of these two international standardised tests indicate that the ability of Indonesian students to understand complex information and in problem solving, analytical thinking and investigation was very poor [1].
Compared with the previous curriculum in which teachers dominated the science lesson, the development of new curriculum, as signposted in the teacher guidebook, will give more room for dialogue to take place in the science classroom including chemistry classrooms. The book shows that, in the introduction stage, teachers should initiate every lesson with a probing question to engage students in the topic studied. This initial discussion will be followed by an experiment or exploration, group discussion and classroom discussion. Given the fact that there has been no research attention paid to classroom talk in Indonesia’s secondary chemistry classrooms, the researcher conducted the study in this field to give a contribution on the development of science education in Indonesia.

The study aims to explore the dialogue in secondary chemistry classrooms that implement the curriculum 2013. In order to achieve this research purpose, the researcher focus on the pattern of interaction occur during chemistry lessons and teachers’ intervention in promoting talk. To understand classroom talk a number of studies examine the structure and pattern of interaction between teacher and students during discussion. Scholars identified a three-part sequence movement in classroom discourse called initiation response and feedback (IRF) [2,3,4]. The classroom talk starts with an initiation (I) from the teacher, which will stimulate students’ response (R). Then, this interaction will be followed by the feedback comment from the teacher (F). As the development of this pattern, some scholars identify another pattern that they call nontriadic IRFRF chain. In term of pedagogical intervention, scholars in the field of science education recognized various strategies that teacher used in promoting classroom talk including elicitation, repeating students’ idea, marking students’ idea, shaping students’ opinion, developing epistemological line, and sharing classroom experience [5,6,7].

2. Method
Over the last three decades, various approaches have emerged within the qualitative research paradigm, such as ethnography, grounded theory, case study, phenomenology and historical research [8]. Given the fact that the present study aims to explore in-depth the talk in secondary chemistry classrooms in Indonesia implementing the curriculum 2013, a case study is a suitable approach for this study. The researcher carried out this study at one public Islamic senior high school (Madrasah Aliyah Negeri) in the eastern part of Greater Jakarta. The researcher selected this school using a non-probability sampling technique called purposive sampling strategy since the bureaucratic process for conducting research in schools is complicated unless the researcher has access to the school. Mr. Budi a young teacher at this school agreed to participate voluntarily. The researcher found the teacher is very supportive since he has collaborated previously with researcher.

The data were gathered using classroom observation methods. Observation is an important primary source of data for qualitative research. Scholars suggests that participant observation is the best methods when activities, event and situation can be see first-hand [9]. The classroom observation is only half the process of generating data. To be able to analysed, classroom observation should be recorded. There are various ways of recording observation, such as writing a field note, audio recording, and video recording [9,10,11]. Considering the advantages and disadvantages of recording approach for classroom observation, the researcher wrote a field note for each observation and recorded the observation using audio and video recorder. In total, the researcher observed six lessons within the period of three months.

Data gathered then analysed using thematic analysis. Thematic analysis is a method for identifying, analysing and reporting themes in qualitative data [12,13,14]. The thematic analysis approach used in this study is the one which developed by Braun and Clarke in 2006. Thematic analysis steps applied were familiarisation the data, initial code generation, searching for themes, reviewing themes, defining and naming themes and report writing [13]

3. Result and discussion
Classroom observations indicated that teacher used various strategies in promoting talk and both triadic (IRF) and nontriadic patterns (I-R-F-R-F) chains were adapted during chemistry classroom as can be seen from the following excerpt which taken from the Mr Budi’s Classroom when they discussed about electron configuration. Four sequential excerpts from the teacher-students dialogues which happened
During the class discussion are presented below. In other words, the sections are presented in consecutive order as they happened in the classroom.

Episode 1
Mr Budi: Do you still remember our last lesson?
Students: Isotope, Isotone, Isomer

Mr Budi: Isotope, for the isotope which number is equal? Proton, neutron or electron?
Students: Proton

Mr Budi: Yes, proton. What about isobar?
Student: Neutron

Mr Budi: Are you sure?
Student 3: Atomic number
Mr Budi: Almost.
Student 4: Atomic

Mr Budi: Yes, atomic number or atomic mass. What about isotone?
Student 5: Neutron

Mr Budi: I cannot hear you?
Students: Neutron
Mr Budi: Alhamdulillah, you still remember the last lesson.

The teacher initiates (I) dialogue by asking the student about their last lesson “do you still remember our last lesson?” Students show a short response (R) such as Isotone, isomer and isotope. Teacher then deliver a feedback (F) followed by new initiation which shows that the IRF pattern is adapted at the beginning of this episode. This IRF cycle was adapted until the end of the episode. In term of the strategy used in the episode, it is clearly that teacher reviewed the last lesson by using elicitation. Teacher used direct elicitation to see what students already know and understand related to the topic they discussed [5]. Once the teacher satisfied with the students’ responses, “Alhamdulillah, you still remember the last lesson”, the teacher shifted the dialogue to the topic of periodic table, as can be seen in the following episode.

Episode 2
Mr Budi: Now we continue our lesson to discuss about electron configuration. Pease look at the picture on the screen. Have you seen this picture before?
Student 6: Yes, in the text book

Mr Budi: What picture is this?
Student 6: Periodic table

Mr Budi: Yes, periodic table, Do you have periodic table?
Students: No

Mr Budi: The periodic table is available in your text book and module. But it is better for you to have it. What is this represent?

Students: Atom

Mr Budi: Atom or atomic symbol. If I draw atomic symbol, what is this (pointing to atomic mass)

Students: Atomic mass

Mr Budi: This one

Students: Atomic Number

Mr Budi: So, this periodic table helps you to know the atomic number and atomic mass. How this system periodic relate to electron configuration? What does the atomic number represent?

Students: Neutron

Mr Budi: Are you sure?
Students : Number of proton
Student5 : Number of electron because number of proton equal to electron
Mr Budi : Yes, correct. For example, Na 11, how many electrons does it have?
Students : 11
Mr Budi : OK, seems everyone understand.

The episode began by Mr. Budi asking his students to look at the periodic table picture on the screen. He then checked students understanding about the periodic table to make sure if students know what the periodic table represented. One interesting moment is that when Mr Budi ask about what the atomic number represented. Students gave a short response “proton”. He then challenged this idea and one student then clarify that the atomic number might represent the electron since the number of proton equal to number of electron. This is an evidence that in this episode Mr Budi use some strategies such as providing clue to students by displaying picture, repeating students’ idea and challenging students’ idea. In term of the pattern of interaction, as labelled in the episode, this part of talk adapted IRFRF chain instead of traditional IRF pattern. The discussion then shifted to the teacher’s next agenda, as can be seen from episode 3 below.

Episode 3
Teacher : Now we move to electron configuration. Any questions before we continue? (I)
Students : No (R)
Mr Budi : So, we can continue. Please look at this picture (teacher display Bohr atomic structure) Bohr suggest that atom consist of certain orbital like solar system. Look at this, there is first orbital, second and third orbital. There is different electron at each orbital. First orbital has 2 electrons, second orbital 8 electrons and third orbital eighteen electrons. (F)
If we see the number in term of arithmetic sequence, can you find the formula? (I)
Students : 2n (R)
Mr Budi : Almost correct, it is 2n square (F)
OK let’s continue. If we have Na-11. First orbital has two electrons. How many electrons left? (I)
Students : 9 (R)
Mr Budi : How many electrons are in second orbital? (F)
Students : 2 (R)
Mr Budi : What about the third orbital (F)
Students : 1 (R)
Mr Budi : Correct. It is easy isn’t it? So the configuration 2, 8, 1 (F)
What about K-19. How many electrons are in first orbital? (I)
Students : 2 (R)
Mr Budi : Second Orbital (F)
Students : 8 (R)
Mr Budi : Third Orbital? (F)
Students : 9 (R)
Mr Budi : For atoms that has less number of electron, the maximal number they have in third orbital is following the second orbital, 8. Since, K, has less electrons , it will follow the rules of second orbital. So K has 8 electrons in the third orbital and 1 in the fourth orbital. So it will be 2,8,8,1 understand? (F)

As can be seen from the episode above, it is clearly that the episode adapted both triadic IRF pattern and non-triadic pattern. Moreover, in term of pedagogical intervention, the episode shows that teacher used the strategies that called developing the conceptual line and developing epistemological line [6]. Developing the conceptual line is a pedagogical intervention which is directed towards shaping ideas, selecting plans and marking key ideas. When shaping students’ ideas, teachers may guide students
through the step of explaining by using clues, paraphrasing students’ ideas, and differentiating ideas that are presented by their students. Moreover, to introduce the aspect of the nature of scientific knowledge (for example, generalising scientific explanation), teachers may use an intervention called “developing the epistemological line”. This kind of intervention occurred in this episode when Mr Budi explaining the nature of Bohr Orbital.

Episode 4
Mr Budi: Now, it is time for group working. Please sit in your group of four students, as usual. This is a work sheet. Group 1 do number one, group two do number two et cetera. OK?
Students: OK Sir.
Mr Budi: Please do it in group
(Teacher give sometimes to group work)
Mr Budi: Now, please send your representative to write the configuration on the board.
(Each of team representative draw their configuration on the board)
Mr Budi: What do you think? Are they correct?
Students: Yes
Mr Budi: What about number three? Who did number three?
Students: We did it Sir
Mr Budi: Please have a look the third orbital. Is it correct?
Students: No sir
Mr Budi: Can you fix it?
(Student then fix the mistake.)
Mr Budi: So everybody understand?
Students: Yes
Mr Budi: Any questions
Students: No
Mr Budi: OK, let’s review, for the electron configuration which follow Bohr atomic structure how many electrons in the first orbital
Students: two
Mr Budi: second orbital
Student: eight
Mr Budi: third orbital
Students: eighteen
Mr Budi: Yes 18, for the atoms that have less electron than 18, there will be 8 electrons in third orbital. Understand?
Students: Yes Sir
Mr Budi: OK, Time is over and that’s it for today. See you next week.

The last episode shows group activities and the last stage of the lesson or closing section. The group activities are important in supporting students to have classroom experience. By managing group activities teacher’s help students experience the classroom activities and construct their knowledge based on the experience they have from a group and classroom discussion [5,7]. In addition, the last episode shows the teacher usually recaps what has been learned by the students. Teachers also use this opportunity to determine whether or not students have understood what was discussed [5,6]. As can be seen from the excerpt above, Mr Budi managed the classroom talk at the closing stage by using strategies similar to those used in previous stages. He marked and collected students’ ideas. However, he did not elaborate on or explore the idea. He closed the lesson with a fixed purpose by concluding the lesson and ensuring the message on the topic was well delivered.
4. Conclusion
The study shows that classroom talk during chemistry lesson was adapted both triadic (Initiation Response Feedback/IRF) and nontriadic (IRFRF chain) pattern. The episodes demonstrates clearly that the teacher employs various techniques to promote talk: direct elicitation, cued elicitation, developing the conceptual line, and literal recap. However, it is clear that the teacher did not elaborate and explore students’ ideas. Students shared knowledge without critically engaging. Consequently, during the classroom discussion students construct their knowledge by making a list based on teacher questions without exploring them more deeply. Inviting students to think more deeply on the topic discussed will be beneficial for students. Delivering questions such as “Why do you think that why?”, “Can you tell me more about that?” will maintain the dialogue and encourage students to think and develop their knowledge. In addition to the conclusion, the researcher like to offer recommendation. There are aspects that have not been explored in this study that may need to be investigated in the future. This study did not focus on how support from the school, the foundation, or the surrounding environment affects how talk takes place in the classrooms. The research could be replicated at the secondary school across Indonesia, and it would be interesting to compare the experiences of teachers and students from different regions across the country.

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