Levels of Discourse in Mathematics Classroom using Lesson Study and Open Approach

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Abstract. Start your abstract here... This research aimed to analyze levels of discourse in mathematics classroom using lesson study and open approach. It use of qualitative research methodology by focusing on protocol analysis and analytical description. Target group was a mathematics teacher and 30 seventh grade students in 2nd semester of school year 2017 at Kaeng-Khro Wittaya School, Chaiyaphum. The research instruments were consisted of lesson plan, field note, students’ writing work, video recorder and camera recorder. The collected data was analyzed by 4 steps of open approach [7], and levels of discourse [19]. Research result found that levels of discourse in mathematics classroom represented as following details: 1) Posing open-ended problem, it was found 4 levels of discourse. In early class of learning unit, it was found the level of 0-1 which the teacher had posed open-ended problem before explained the problem with asking some short question to the students for checking their understanding whereas in latter class of learning unit, it was found the level of 2-3 which the teacher had posed open-ended problem then the student questioned and discussed the problem together; 2) Students’ self learning, it was discovered 2 levels of discourse which were the level of 2-3. In this discourse, students had questioned and explained about problem solving methods and the teacher had asked the students to clearly describe their problem solving methods together; 3) Whole class discussion and comparison, it was found 2 levels of discourse which were the levels of 2-3. In this discourse, students demonstrated and expressed their own problem solving ideas and other students questioned about their own doubt about each ideas in classroom. The teacher ordered the students’ ideas presentation; 4) Summarization through connecting students’ mathematical ideas emerged in the classroom; it was showed 2 levels of discourse which this learning unit was found the levels of 2-3. In this discourse, teacher encouraged the students to confirm the ideas obtained from listening to reasons of each idea together for discussion and summarization in classroom.

1. Introduction
In results of Programme for International Student Assessment (PISA) test, it indicates that mean scores of Thai’s students in all skill such as reading, mathematical and science skill are quite smaller than OECD mean score [7]. One of these causes that affect the obtaining low score in PISA of the students is teaching quality which teachers behave as a lecturer, but not indeed promote students’
knowledge [15]. This reflects that tools used for learning management are defective, especially, teaching method (Inprasitha, 2014). The National Council of Teachers of Mathematics (NCTM) suggested that learning management in mathematics classroom should supply a student to student conversation activity to develop their understanding in mathematics [13].

Lesson Study is a teacher development innovation which can solve abovementioned problems because the Lesson Study is the innovation that focuses on learners importantly and aims to develop teachers gradually and continuously [6]. In Thailand, it was applied in a learning management innovation called open approach which is teaching approach [7]. Features of open approach classroom are to debate various students’ ideas and to develop their attitudes by facing experiences with themselves and to provide reasonable suggestion by teacher which aims at discussion and mathematical idea exchange [14]. This idea exchange is more important in learning mathematics [13], which most teachers have not experienced yet. And the most difficulty of learning-teaching mathematics management is to transform teacher-centered learning discourse to basic concept and student-centered learning discourse.

The discourse in mathematics classroom is a part of learning mathematics. The discourse could help students to explain, express their reasons and discuss each mathematical solving technique and support the students to understand the ideas [20]. Format of discourse can be found from speaking words in mathematics classroom [4]. The discourse in mathematics classroom detected by speaking words can be determined as level of discourse by considering character of participation between teacher and students via questioning in classroom. This will encourage student to explain their mathematical ideas, origin of mathematical ideas and debates which can be classified into 4 levels of discourse. The abovementioned patterns of discourse are advantage to set up mathematical criterion for mathematical conversation and working conversation in mathematics classroom [5].

As above-mentioned, the mathematics classroom problem is the former learning-teaching management which teachers transfer mathematical knowledge to students via explanation or expressing mathematics contents in classroom. This showed the discourse of teacher-centered learning. To enhance the quality in classroom to be a focusing on solving problem and self-studying, especially, the discourse of student-centered learning, it requires estimating the level of discourse in the classroom to be considered and taken to improve its mathematics classroom quality. Then, this study will analyze the level of discourse in mathematics classroom using lesson study and open approach.

2. Research Objectives
To analyze the level of discourse in mathematics classroom using lesson study and open approach.

3. Research Methodology

3.1. Target Group

3.1.1. 30 students in grade 7 of Kaeng-Khro Wittaya School, Kaeng-Khro district, Chaiyaphom, which are in mathematics classroom using lesson study and open approach.

3.1.2. 1 mathematics teacher of Kaeng-Khro Wittaya School, Kaeng-Khro district, Chaiyaphom.

3.2. Research Instruments

3.2.1. Mathematics learning activity plans for grade 7: Unit 1: Positive and Negative number.

3.2.2. Video (VDO) recorder used for recording the activity in mathematics classroom and being raw data taken to analyze.
3.2.3. Camera used for picturing students’ work and activity.

3.2.4. Sound recorder used for recording the conversation between teacher and students during mathematics class.

3.2.5. Field Notes used for noting students’ behavior during solving problem and ideas generated by students.

4. Data Collection

4.1. Researcher, Researcher assistant and teacher co-work
In education process in classroom for design learning plan consisting of 3 steps; 1) Learning plan co-designing which researcher, researcher assistant and teacher design learning plan by following a books published by Keirinkan and Japanese mathematics book published by Gakkotosho. 2) Co-observation which Researcher, researcher assistant and teacher collect data and teacher teaches students via open approach. 3) Classroom reflection which researcher, researcher assistant and teacher reflect their own opinion after classroom.

4.2. Researcher and researcher assistant
Attended a meeting to understand analysis framework and assign works to researcher and researcher assistant.

5. Data Analysis
This analysis is a qualitative analysis. Researcher will use data in protocol of solving problem of students in mathematics classroom using lesson study and open approach collected by VDO & sound recorder, students’ works, protocol interview, field note and protocol reflection of researcher for analysis levels of discourse in mathematics classroom using lesson study and open approach following the idea of Stein (2007) and Inprasitha [7].

6. Results
From the study of level of discourse in mathematics classroom using lesson study and open approach, in the content about positive and negative number, it was found 4 levels of discourse in mathematics classroom using lesson study and open approach as follows,

- Level 0; in this level, the teacher asked a question and confirmed answer correction, while students answered the question shortly. Then teacher suggested and explained about mathematical idea to the students.
- Level 1; in this level, the teacher asked a question frankly about a student’s idea, while other students listened to the teacher explaining about the student’s idea and students noted data before next student’s idea explanation began. Teacher might ask some students to help the student solving the problem.
- Level 2; in this level, the teacher asked open-ended question to encourage the students’ thinking and allow them comment about another student’s work. Students commented the ideas willingly. The teacher confirmed and determined the direction of learning based on the students’ explanation.
- Level 3; in this level, the teacher served the students to discuss by supporting them to ask some question to each other and another student explained his/her own idea. The idea of classroom was created from having the student expressed and explained the origin of their ideas intensively and then other students listened to his/her explanation. Teacher asked about solving method and idea for checking their understanding.

From the study of level of discourse in mathematics classroom using lesson study and open approach, it was discovered 4 levels of discourse in each open approach steps as follows,
Posing open-ended problem; in this step, it was found 4 levels of discourse. Level 0; the teacher asked a question to the students for only confirming answer correction. The students gave the short answers about problem situation. Level 1; the teacher asked about problem situation directly and methods that the students used to solve their own problem, while other students listened to the presenting student. The teacher explains strategy of presenting student to other students to check their own ideas. Level 2; the teacher gave a problem situation and asked open-ended question to students and they explained their own solving problem ideas. And level 3; the teacher promoted students to ask the presenting student and he/she explained and understand his/her own problem situation.

Students’ self learning; in this step, it was found 2 levels of discourse, namely, level 2; students gave their reason based on their ideas generated from open-ended question from teacher and classmate in classroom. Students commented “agree/disagree” to other students’ ideas which they have same/different opinion to, respectively, and level 3; the students asked a presenting student some questions to explain his/her idea to other. The teacher served the presenting student describes his/her own idea for clearly understanding.

Whole class discussion and comparison, it was found 2 levels of discourse, that is, level 2; the teacher ordered students’ presentation to activate students’ idea presentation. Then other students commented and compared the others’ ideas, and level 3; the teacher promoted students to ask the presenting student and the presenting student expressed his/her idea clearly.

Summarization through connecting students’ mathematical ideas emerged in the classroom; it was found 2 levels of discourse, namely, level 2; from the idea presentation which support the students commented their own opinion on others’ solving problem idea, teacher and students confirmed the idea by giving opinion together. And level 3; from students’ idea presentation in this step, student made other students accept his/her idea by describing his/her reason. Teacher supported students to confirm classroom’s idea obtained from listening to and sharing ideas together.

7. Conclusion
From the study of level of discourse in mathematics classroom using lesson study and open approach, it can be discussed as step of open approach idea of Inprasitha [7] as follows; Posing open-ended problem; in this step, teacher take students to open-ended problem situation and stimulate students’ idea via questioning. Explanation can lead students to correct way. In addition, teacher give a chance to students for asking about idea or possible outcome which has many ideas, then it is found 4 levels of mathematics classroom discourse. However, at the beginning of learning unit, it is found the levels of 0–1. The teacher had posed open-ended problem before explained the problem with asking some short question to the students for checking their understanding and in latter class of learning unit, it was found the level of 2–3 which the teacher had posed open-ended problem and then the student questioned and discussed the problem together. Students’ self learning presented 2 levels of discourse which are level of 2 and 3. Teacher allows students to learn by themselves from solving problem together. But sometimes teacher ask open-ended question to students for stimulating students’ opinions or asking students’ idea during solving problem to demonstrate to others understand together. Moreover, for solving problem in each group, students discuss about strategy to solving problem which emphasize various ideas during solving problem via questioning. Whole class discussion and comparison; it was found 2 levels of discourse which are level 2 and 3. Students posed the idea that they have solved together. Teacher support students to question the presenting student and presenting student describe the idea. Then many ideas generated from self-learning are presented in classroom and students have learned and understand many ideas. Summarization through connecting students’ mathematical ideas emerged in the classroom; it was found 2 levels of discourse, namely, level 2 and 3. Teacher encourages students to comment about their own and others’ ideas and demonstrates the origin of idea via questioning and find the conclusion idea together.

The learning activity using open approach following idea of Inprasitha [7] supports students using discourse for solving problem in classroom by open-ended question asked by teacher. This shows 4 levels of discourse. Mostly, it was found the level 2 which teacher asked open-ended question to
encourage the students’ thinking and allow them comment about another student’s work. Students commented the ideas willingly. The teacher confirmed and determined the direction of learning based on the students’ explanation. And level 3; the students asked a presenting student some questions to explain his/her idea to other. The teacher served the presenting student describes his/her own idea for clearly understanding. These are corresponded to Nampreeda [12] which told that open-ended problem situation can support students to use mathematical discourse in classroom following theory of Lakatos (1976). Students apply conversation and presentation process to express their own idea. And giving a reason is used in group discussion which is corresponded to Phuengphon and Inprasitha [17] said that in mathematics classroom using lesson study and open approach, there is mathematics discourse appearing and it is used all the time by beginning with teacher who starts to use discourse.

8. Recommendation

8.1. Recommendation for Implementation of Research Findings
This research can be used in different content via open approach learning using open-ended problem situation to allow students express, explain their ideas and give a reason for solving problem method. This can promote the level of discourse in classroom.

8.2. Recommendation for Further Research
It should be study on how levels of discourse between teacher and students, or students and students, do support the students understanding, in order to use the result in planning and implement the lesson to promote the students’ understanding in mathematics learning meaningfully.

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