Siti Faizah

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Teachers' Communication in Mathematics Learning Based on Zone of Promote Action

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Abstract. Zone of promote action is an oral communication conducted by teachers or those who are highly skilled at promoting learning material. Vygotsky (1978) stated that a learning can occur when students first collaborate with people who are more competent to complete tasks beyond their ability level. This qualitative research aims to explore the oral mathematical communication of mathematics teachers in promoting geometry materials especially cube to junior high school students. The subjects of this study were novice and senior teachers of junior high school. The instruments used in this research were observation sheets, videos, and interviews. The results of this research show that the novice teachers promoted the material to students using cube nets as props, providing stimuli, and giving the students questions to work on the blackboard. Meanwhile, senior teachers promote the material by giving first perceptions, providing scaffolding, giving questions, giving guidance to students who have difficulty in solving the problems.

INTRODUCTION

Communication and learning process are two inseparable things. In the learning process, it cannot be separated from teachers and learners, because the learning process in education aims to achieve social relations [1]. Communication that occurs between teachers and learners is be a process of providing assistance or scaffolding [2]. In other word, scaffolding is teacher's assistance to learner in the learning process.

Communication in learning is not just a conversation between teachers and learners, or learners with learners, but also includes listening and joining discussions for clarification, questioning and expanding conjectures [3]. Teacher and learner can reveal ideas through communication process in learning. Communication skills are the ability of learners to express ideas, describe and discuss the concept of mathematics clearly [4]. The communication between teacher and learner can occur through the learning process which resulted in two-way interactions between

teacher and learner. New ability offered by the teacher can be a concept or others. In offering a concept, the teacher can express a simple definition or explain the steps of solving mathematics problems [5].

Communication in mathematics learning emphasize on reviewal which stated that the best effective learning is in a social context. Social constructivist perspective goal is for learners to be able to discuss with their teacher and partner actively. The constructivist social perspective aims to enable learners to have an active discussion with their teachers and peers to gain a better understanding of the mathematics conceptual foundations and become better problem solvers [6][7]. This is supported by the Vygotsky's theory (1978) which states that learning occurs when learners first collaborate with adults or competent partners to complete tasks beyond the level of independent learning ability, this occurs within the proximal development zone (Zone of Proximal Development). What is achieved in a social context is then internalized for individual mastery [6][8].

According to Vasiner (1987), there are two types of ZPD. They are zone of free movement (ZFM) and zone of promote action (ZPA) [9][10][11][12]. ZPD is a set of possible ways developed by individual learners. Then in ZPD there is ZPA as a set of activities promoted by teachers to influence learner activity. ZPA is strongly associated with ZFM as an internal and external boundary of learners to perform an action with the consent of the a more expert person [11][12][20]. Those three zones can be described as Figure 1.

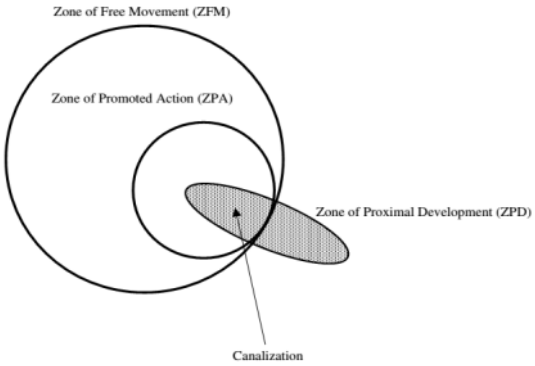

Figure 1. Three Zones

Teacher assisted learners through constructivist process. In finding new knowledge, learner can interact and communicate with people who have better understanding; they can be professional teachers or partners. Vygotsky (1986) extends the ZPD concept of teacher or peer interaction with more expertise in finding new knowledge, resulting in collaborative ZPD in learning [13]. Learners' mathematics understanding will get better if they get intervention from teacher through interaction process [14].

Vygotsky's perspective on learning contains Zone of Promote Development (ZPD) which is a characteristic space for scaffolding through expertise people [9]. ZPD is a zone between what a learner can do without help, and what they can do with help [15]. Valsiner (1983) extends the idea of Vygotsky by adding two interaction areas to ZPD, namely Zone of Free Movement (ZFM) and Zone of Promoted Action (ZPA). ZFM is an action that children can take to disclose ideas without the permission of a more skilled person. While ZPA is a real action done by people who are more expert in promoting an idea to influence the behavior of children [10][16].

ZPA is a branch of ZPD which focus on series of activities offered by professional and orientate to promote or offer new information in the process of mathematics learning. This new information can be a concept or other mathematics object. The framework of teacher and learners' activity in doing communication based on ZPA can be seen in Table 1 [10][11] [13].

TABLE 1. The framework of teacher and learners' activity

Category	Teachers' Intervention
• Learner cannot do without teacher or others dominant learner	• What is your question? • Divert the question to the group. • Direct explanation to group member. • Refer to other source.
• Assist/ leave/ silence	• Leave the group with assignment. • Follow all processes.

Category	Teachers' Intervention
• Zone	• Divert the question. • Push learner to work individually. • Compare the strategy.
• No participation from the learner	• Explain what it does. • Ask another learner to explain or repeat the answer. • Another answer from learners' question.

There are two possibilities that occur when the teacher communicates with the learner during the lesson; the learner can accept or reject the promotional actions performed by the teacher [11][13]. This promotion can be done during the process of learning through communication process between teachers and learners. This promotion aims to give assistance or scaffolding to learners in understanding a mathematics concept. There are some possibilities that happen when teachers promote an object of learning to learners; learners cannot work without the help of teachers or other learners who are more expert, learners can work in private, learners do not respond to what the teacher said, and teachers ask learners to repeat what has been delivered [10]. Therefore, that the main point of this research is to know how is the teachers' communication in mathematics learning based on Zone of Promote Action (ZPA) performed?

RESEARCH METHOD

This research is a descriptive exploratory with a qualitative approach. The subjects of this study were novice and senior teachers in junior high schools with the researcher as the main instrument supported by the auxiliary instruments namely observation sheets, interviews, and video recordings. The observation sheet is used to observe teacher's communication in promoting mathematics learning material to the students in order to know the teacher's ZPA. The research procedure was conducted by observing and recording the mathematics learning process using a video recorder. Then the researchers conducted unstructured interviews with subjects related to the learning that had been conducted.

The data was analysed by using qualitative data analysis techniques which include: (1) data transcripts, defined as the research data that has been collected through recording which was then transformed into transcripts. (2) data examining in which the data collected from the interviews and observations is analysed by reading it repeatedly to obtain the accordance data to the research objectives. (3) data reduction, meant selecting the data which is not in accordance with the research objectives. (4) data credibility, which is used to determine the validity of the data in which triangulation method is used. Triangulation is done by adjusting the obtained data during the interview with the observations during the learning process. (5) drawing conclusions, which are used to develop a new theory according to the data analysis stages

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RESULT AND DISCUSSION

The research result showed that novice and senior teacher have different way to promote about cube material to the students. The first subject is novice teacher explained all the learning materials to learners as a beginning activity. Teachers convey to the learners by inviting them to recall their previous knowledge about cube.

T : Well ... now we are going to discuss about the cube first
Do you know what the difference between cube and block is?
If it is the cube… All sides are…
L : Same… (simultaneously answered)
T : How many sides are in a cube?
L : Four …
Six…
Eight…

(the learner's queried)

T : Is it six or eight?

L : Six …
Eight…

T : Eight or six?

L : Eight…
Six…

T : The teacher repeats the same question three times to test students' understanding of the previous material
Do you know where the side is? What is side?

L : Side is line…
Side is part
(the learner's queried)

T : Well, the side is the face. For example, there is a cube… I will draw it… (the teacher draws on the board and the student pay attention to the teacher's drawings)
So…this drawing is called a cube because it has similar sides
And from those, we can say that a cube has…how many sides?

L : Six… (the learners answer simultaneously)

The teacher conveys the material about cube through stimulus to the learners by asking learners to interact until they find the number of edges in the cube. Teacher gave stimulus to construct learners' knowledge of the material received at the previous level [17]. Therefore, that the knowledge received by learners regarding the number of edges on the block is not directly obtained from the teacher but the result of their own construction. The teacher only guides the learners to get the right answers.

Then in giving the question, the teacher did not ask the learners to do it in the book or work in groups, but instead the teacher asks one representative to come forward to solve the problem on the board. For example:

T : Does it clear enough?... if you already get it clear. I will give you another question
So…if there is a solid figure with the shape like a cube with a side length of 17 cm each, how long is the wire needed to make a cube frame of 17 cm in length? Ok, please count ... for those who have finished please come forward

L : $S \times 12 = 17 \times 12 = 204$
(a student who has found the answer while solving in a notebook, came forward to work directly on the board)

T : Ok ... so the length of wire needed to make a cube-shaped object with a side length of 17 cm is …

L : 204 cm (answer the students simultaneously)

T : Is there any wrong answer? Is there any other answer besides the one written on the board?
Why are you silence? Does it mean that you find the answer?

L : We did it, sir…

The teacher gives the learner another question by asking the learner representatives in one class to come forward to solve the problem on the board. There is one learner who solves the problem on the board, even though the learner has not tried to count it on the notebook. Learners gave correct answers from the questions given by the teacher, so in this case the teacher does not ask learners to do the problem individually or in groups but the teacher directly asks learners to solve the problem on the board then discussed it together. From the answers given by the learners, the teacher guides the learners in finding the length of the wire to make the frame of a cube which is 204 cm, by the way the edge length is known multiplied by the number of edges on the cube.

Based on the explanation above, the teacher's promotion and the learners' activities in solving mathematics problem can be seen in table 2 below:

TABLE 2: Teachers' Promote Action in Learning Mathematics

Teachers' Promote Action	Students' Activities
• The teacher constructs students' knowledge regarding the material that has been received at the previous level. This is done by providing a stimulus in the form	• The students gave answer orally toward the teachers' stimulus

Teachers' Promote Action	Students' Activities
of a question • The teacher gave the students the opportunity to solve the problems on the whiteboard so that other students can see their answers.	• The students actively participated during the learning process. • The students wrote their answer on the blackboard.

Stimulus and response are two things that are interrelated in learning mathematics [21][22]. The novice teacher gave a stimulus in the form of questions about the elements and volume of the cube to the students. Then, he gave questions to determine students' understanding of the material. When the teacher asks students to do the questions, he does not go around the class to provide guidance to students who have difficulty but he immediately asks students to do on the blackboard. This causes students who do not understand become passive and active students will offer to solve problems on the blackboard. The teacher only provides guidance to students who find it difficult when doing on the blackboard, so students who are not proactive will not get the teacher's attention. At the time of learning, there were also students who did not respond to the stimulus because they were not interested in participating in mathematics learning. Students who do not respond to the stimulus from the teacher can be said to refuse to promote the given action because they do not understand the material being studied [13].

Then, for the second subject is a senior teacher. He did the learning process by delivering the material starting from explaining root then related to the volume material of the cube.

T : (Writing cube root of 15.625 on the board)
Who still forget how to find this?
L : Remember sir… but we are afraid of reverse.
T : Who still remember, what is the result?
L : 25 Sir…
T : Good job…
Now we will learn to determine the volume of the cube. Since the cube has the same length of edge, so just write r, then $V = La \times r = r \times r \times r$ (the teacher writes the formula and describes the shape of the cube on the board)
What is the base known in the book?
L : 441 (answer the learners simultaneously)
T : So… La = 441. Is it right? Then how about the volume?
L : It is not, sir…
That's what we are going to find
T : Oh…ok, so should we find out the volume…
L : Yes
T : How?
L : 441 multiply by…
T : 441 multiply by… what? What is the shape of the cube base?
L : Squar
T : What is the area of square?
L : $r \times r$
T : So the area of square is…
$L = r \times r$
L = 441
S = square root of 441
L : Is it the same with cube root, sir?
T : No…it is different
If the square root, it is multiplied by 2x…here is the example…the square root of 64 is 8. Why? because 8×8 is 64.
So… how with square root of 441?
L : 21 sir…
T : Good.

> Yes. If you have met the answer then put in the volume, V = r × r × r. Try to count it yourself … (while teacher moves around the class to see the students, this is done so that the teacher know that the students have or have not understood the materials then the teacher can explain it to them)

The teacher conveys the learning material by giving question about root. Next the learners are given question about the cube volume. The teacher did this to remind the learners about root on the previous material which is then associated with the cube volume material. The teacher guided the learners to find the formula of the cube volume by connecting the base formula, so that it obtains $V = La \times r$ or it can also be written $V = r \times r \times r$.

Then the teacher presented more problem to the learners "if a cube wide is known so how much is the volume?". In this case the teacher asks the learners to do on their own, but there were learners who discussed the problem with their friends, there was also a learner who asked directly to the teacher, and others also did the work individually without asking his friends. The self-learner took a long time to finish and find the end result, he prefers to concentrate on solving the problem according to his ability rather than asking his teacher or his friend. After the students have met the results, the teacher asked learners to do the next problem in their notebook. In this case the teacher did not discuss the problem before, because the teacher had been around the class to check the answers of the learners. From this second subject, the activities can be seen in Table 3.

TABLE 3: Teacher's Action Promotion and Student's Activity

Teacher's Promote Action	Student's Activities
• The teacher gave apperception to recall the previous material about roots	• The students responded to the apperceptions by answering questions regarding to the root material
• The teacher provided scaffolding to the students to determine the area of the cube by using the concept of the root number.	• The students were able to determine the area of the cube based on the scaffolding from the teacher
• The teacher gave question about the material studied	• The students actively participated during the learning process
• The teacher asked students to do the work individually	• The students worked individually according to their abilities. • When the student did not understand yet the completion steps, then he or she asked to their friend who understands better or asked the teacher.
• The teacher guided students to do the work in a students' book until the final result	• The students followed the teacher's guidance

Senior teacher use root numbering concept to determine cube volume to the student remember the material given before. Then, he gave questions and ask students to finish it. The teacher did not discuss the questions on the blackboard (like novice teacher) but the teacher has gone around the class to check students' answers one by one while giving guidance or scaffolding to the students who has difficulties. The teacher provides scaffolding to students as a form of assistance so that students are able to construct their knowledge to gain new knowledge [15][17][18]. Students who have had less experience with an area, a field, or a domain will need more scaffolding than those students who have had more experience with that field or domain [19]. In this case, the teacher did not provide a stimulus, just like what had been given by the novice teachers, but the senior teacher directly provides scaffolding as a form of assistance to students.

CONCLUSION

There are differences in the communication activities made by research subjects in promoting mathematical objects during the learning process. The difference is that the novice teacher as the first subject to promote learning material is actively interact with students then asked them to show the results of their work on the blackboard to be discussed together, the novice teachers did not guide students to solve questions individually. Meanwhile, the senior teacher as the second subject promoted the mathematics object in learning by giving questions on different material then linked to the material being studied, after that the subject gave questions to all students to be solved individually but still under the guidance of the teacher. There were students who did not understand, then they asked

the senior teacher how to solve it, next the senior teacher guided the students until they get the final result. There were also students who discussed with their friends who understand the material more than they did, and there were also students who worked individually according to their abilities, although sometimes they had to repeat the calculation process because they got the incorrect answers.

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