ME – 44

Characterization of Spontaneous Examples Based on Teacher and Student Thinking Interaction in Mathematics Learning

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***Abstract*—** When the teachers teach the material in course of study, teacher must be master the subject matter that will be given to students. And when the student will determine concepts that will constructed of material being taught by teachers, students can interact with the teacher to solve a problem, then student will communicating about its opinions so that students find the right solution. At the this interaction activity are among of teachers and students going on interaction process thinking in solving the problems appropriately. This research investigated the characteristics of spontaneous example through thinking interaction of teachers and students in the learning of mathematics. Spontaneous example is an example of is modified or produced by teachers spontaneously. In that case this, how the thought processes the teacher and students to the thinking processes generated spontaneous example and explained by the teacher in course of study of mathematics. The main objective in this study was to assess the characteristics of spontaneous example by thinking interaction Teacher and Student in the learning of mathematics. The results of the research shows that by the thinking interaction of teachers and students in spontaneous example in the mathematics, has produced characteristics of spontaneous example illustrations. In an illustrative example spontaneous consist of 3 (three), namely: (1) simple; (2) equivalent; and (3) expansion (expansive)

Keywords: *thinking interaction, spontaneous example , and mathematics learning*

I. INTRODUCTION

In learning activities are teacher interaction with students that involves thinking of students. This interaction should not rule out the thinking of students. This is due to the thinking of students will determine the form of a concept built by students during the learning activities. Therefore, in the learning of teachers should also pay attention to the thinking of students being able to determine a concept that will be built during the students' learning activities. When the concept was built by students in accordance with the material being studied, the learning objectives have been achieved.

Some research results emphasize the importance interaction in the learning process of mathematics (Elbers, 2003; Steinbring, 2005; Nührenbörger & Steinbring, 2009; Tucker & Harden, 2012). According to Webb (Nührenbörger & Steinbring, 2009) that the interaction of students with regard to solving the problem through the example influential on the results studying mathematics. Nevertheless, the interaction of teachers and students in mathematics, especially the thinking interaction Teacher-Student in learning of mathematics is still less attention.

Thinking interaction in mathematics instruction, as described above, has a great potential to improve student achievement. It is therefore, reforms should how to develop thinking interaction teacher-student in the learning of mathematics, so can be used to improve student achievement, particularly teacher-student thinking interaction associated with the use of examples in mathematics learning. Role of the process of thinking for teachers is to interpret and translate complex concepts to a level appropriate to the student learning experience. It is important that teachers must first develop an understanding of the material will be given to students. When teachers do not fully understand the material well then he will not be able to teach well (Lederman, et al, 2000). This becomes a serious problem when the concepts are

incorrectly delivered to students as a result of a lack of understanding in-depth knowledge of teachers of subjects Sanders (Deborah et al, 2005)

Choose and produce examples in teaching, are often needed in the decision-making during an interaction of thinking in the classroom. In the interaction of thinking, the quality of mathematical knowledge of a teacher dijarkan affect what and how to teach. Zodik & Zaslavsky (2008) argued that knowledge of student learning refers to teachers' understanding of how students can know and how students can construct knowledge there is to gain new knowledge. Furthermore, Simon (1995) connects the teacher's knowledge, pre-planning instruction thinking, and interaction in the classroom that fact often hold spontaneous action. The spontaneous action leads to modification or construction of a new sample, which is often called spontaneous example.

Spontaneous sxamples of raised when students do not understand the material identified by the teacher, or when students make mistakes, or when students may discuss and occurs understanding different concepts, or perhaps when her students respond or claim the teacher's explanation. Zodiac & Zaslavsky (2008), suggests a spontaneous case of the example shown in situations where teachers have a clear plan for a lesson, but no specific examples.

However, the use of examples in mathematics learning, in particular the of spontaneous example still received less attention. As noted Zaslavsky (2011) that in spite of the important role the example in learning and teaching of mathematics, only a small number of research focuses on examples teacher selection and treatment exsample. Similarly, there has been no in-depth studies that reveal the interactions thinking teacher-student that focusing on of spontaneous example.

Questions and Purpose Research

The research question is how the characteristics of spontaneous example based thinking interaction teachers and students in mathematics learning ?. And the purpose of this study was to explores and characterization of spontaneous example based thinking interaction teachers and students in mathematics learning.

II. METHODOLOGY

A. Technique Data Collection

Procedure / stage of data collection is done as follows: (1) the preparation phase, researchers introduced various matters associated with the planned research, including research instruments to check the readiness and determination of research subjects, (2) the data collection phase during the learning process. All the learning process observed and recorded using audio-visual (handycam), well by the time teacher explaining or discuss examples the chalkboard or when the students pay attention to the teacher explanation.

B. Techniques Data Analysis

Data that has been collected and are still in the form the recording, then transformed into the shape of a transcript. Process data analysis in this research is a modification of qualitative research the needs analysis that was developed by Creswell (2010), with the steps as follows: (1) manage and prepare data to be analyzed, (2) read the whole data set, (3) analyzing greater detail with mengcoding a data, (4) decrypting a data, (5) the presentation of data within a narrative / qualitative reports and (6) to interpret or interpret the data.

III. RESEARCH RESULT

Teacher and student were become subjects in this study, will describe how the process of thinking interaction teachers and students in the process mathematics learning in the classroom. Teachers who become research subjects are Mathematics Teacher Junior High School country seven Makassar, while students were become research subjects are grade students of nine Junior High School country seven Makassar.

Teacher explains the material about the rank fraction, teacher implementing a method debriefing in course of study so the atmosphere of in the process learning make students more active. When Master give examples linked to material identified, teacher often refer some of the students for answering the example. Similarly, teacher many give examples (including examples of spontaneous) when explaining lesson material.

The following is presented results of thinking interaction between Master and students. Present was presented with a transcript of the recording process of learning mathematics in the rank of material fractions.

Teacher: Note the following properties, (write 1. $p^{\frac{m}{n}} = \sqrt[n]{p^m}$)

Teacher: What is below (showing *n* at the $p^{\frac{m}{n}}$) ascend to the rank of roots (pointing $\sqrt[n]{p^m}$) the above (pointing m the $p^{\frac{m}{n}}$) becomes rank number $\sqrt[n]{p^m}$

Teacher: It is nature of following (write down 2. $\sqrt[a]{p^b} = p^{\frac{b}{a}}$)

Teacher: (explaining example) Simplify: 1) $5^{\frac{2}{3}}$ 2) $9^{\frac{4}{5}}$ 3) $2^{\frac{2}{3}}$ 4) $\sqrt[4]{81}$

Teacher: Try Ismail mentioned that what you know of these numbers (Pointing $2^{\frac{2}{3}} = \sqrt{}$), call a one!

Student/Ismail : (mention) 2 (two)

Teacher: (write down 2 at the $2^{\frac{2}{3}} = \sqrt{2}$), is called by Ismail

Teacher: (Designate Danial) mention one course

Student: (Danial mention), three sir!

Teacher: (write down 3 at the $\sqrt[3]{2}$)

Teacher: (Designate Sahra) mention, there still that need to written out? Appoint $2^{\frac{2}{3}} = \sqrt{2}$

Student: (Sahra paused and then mention) two !

Teacher: (write down 2 at the $\sqrt[3]{2^2}$)

Teacher: (Designate Sukmawati) Please you read, what reading this! (appoint $\sqrt[3]{2^2}$)

Student/Sukmawati : (mentions) three roots of two squared

Teacher: (Designate Fajar) Fajar could read? (appoint $\sqrt[3]{2^2}$)

Student / Fajar: (answer) forget sir!

Teacher: Well then, all the hear and look!

Teacher: This (pointing $\sqrt[3]{2^2}$) his reading, the cube root of two squared!

Teacher: This (pointing $\sqrt[5]{9^4}$) be parsed again!

Teacher: (writes = $\sqrt[5]{(3 \times 3)(3 \times 3)(3 \times 3)(3 \times 3)}$)

Teacher: Have a look here (pointing $\sqrt[5]{(3 \times 3)(3 \times 3)(3 \times 3)(3 \times 3)}$) all the, so that you understand!

Teacher: So the number 3 released one of (pointing $\sqrt[5]{(3 \times 3)(3 \times 3)(3 \times 3)(3 \times 3)}$) because pass one, whereas the rank 3 because his number was no escape as much 3

Teacher: Thus (write down 3 $\sqrt[5]{3^3}$) this is the simplest form

Student : From where 3 gained sir?

Teacher: Problem number 4 (write down $\sqrt[3]{81}$= $\sqrt[3]{(3x3x3x3)}$

Teacher: Why do not we outlined 9x9 ?, who knows?

Teacher: Because not immediately removed from the roots then we are outlined!

Teacher: Try (write down $\sqrt[3]{81}$ = $\sqrt[3]{9x9}$), can be removed from its roots?

Student : No

Teacher: 81 = 9x9, 9x9 = 3x3x3x3

Teacher: So it $\sqrt[3]{81}$ = $\sqrt[3]{3x3x3x3}$ (write down = 3 $\sqrt[3]{3}$)

Student : Sir, inquired Sir?

Teacher: Please

Student: If it's number 4 be a the rank fractional sir, such as the nature 2 described above, how to sir?

Teacher: explain by delivering some examples of different

The following stated structure thinking interaction teachers and students in the learning process of mathematics subject matter the rank fractional

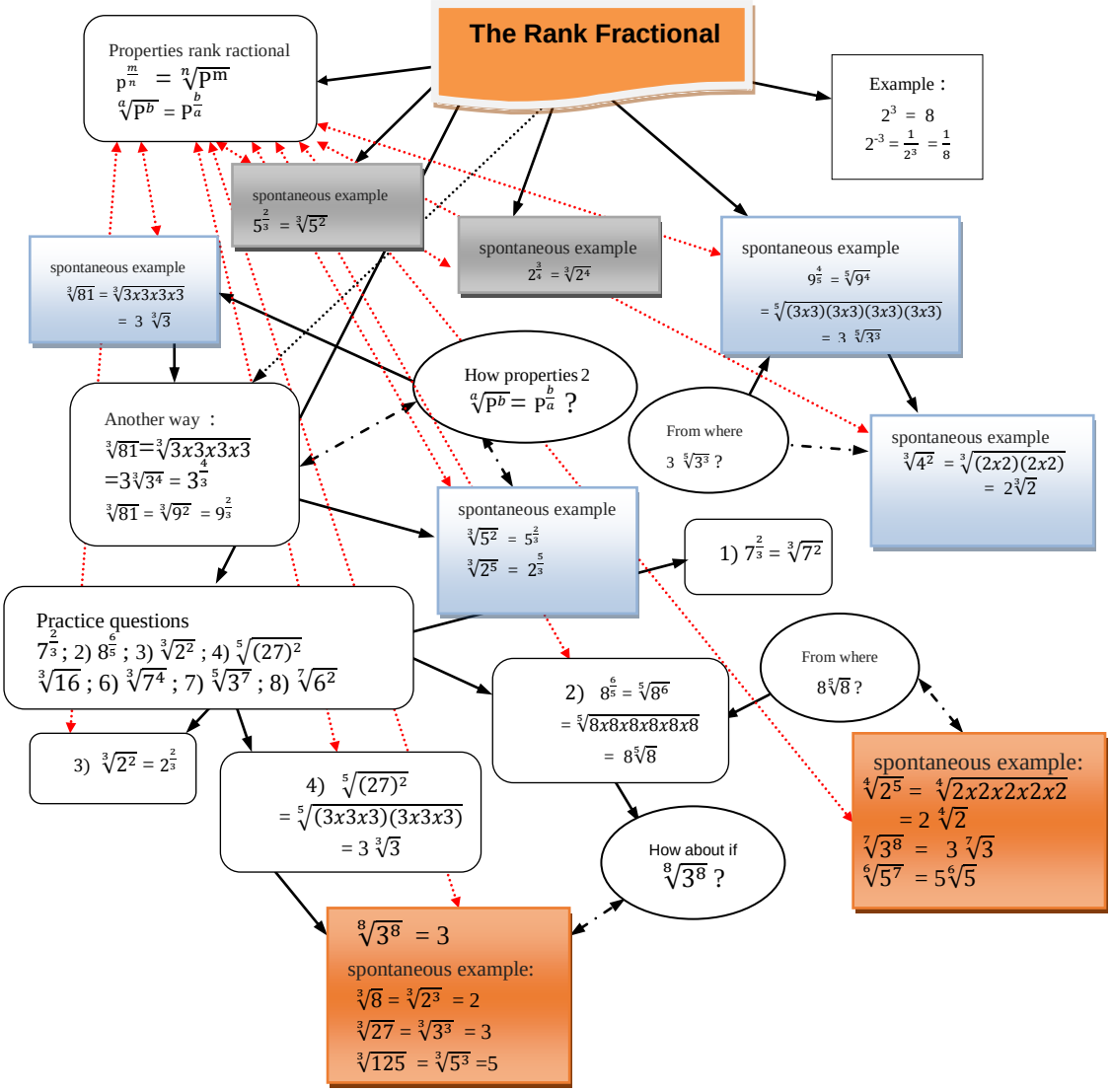

Diagram 2. Structure interaction thinking teacher and student in mathematics learning

Based on observations during the learning process in the classroom and diagram 2 above, teachers more often designate students to answer sample questions written by the teacher. Sometimes students who were not able to answer correctly because they trouble understanding the a concept the rank fraction. However, there are some students who are actively asking about the material identified by teachers. Students often different in mind with what was described by a teacher. So it felt not satisfied with the answers a teacher. This happens because the teacher did not explain in advance the meaning of the material being studied, but directly provide examples. And the examples are written not directly be explained, but it gives an opportunity (pointing) to the students to find the answers.

The thinking interaction between teachers and students at the time of the teacher gives some examples relating to the material the rank fraction. However, by the time teacher gives examples and then explain the example, sometimes students have of understanding or different ways, for example, when a

teacher explain the examples do not like that is in the minds of students because answers from these examples do not like at the properties which force which has been described by previous teachers, so as to make students confused. Eg, the teacher gives an example $\sqrt[3]{81} = \sqrt[3]{3x3x3x3} = 3\sqrt[3]{3}$

In mind the student that ought answers some of these examples should be effective as of correspond to the the nature of or nature of powers of, or answers of the example its shape the rank fraction not cube root. Due to claim of one of his students, the teacher gives some examples the different. Spontaneous example such is an spontaneous example the illustrative its nature expansion of (expansive). Eg, the teacher wrote down another way, namely $\sqrt[3]{81} = \sqrt[3]{3x3x3x3} = 3\sqrt[3]{3} = 3^{4/3}$ Another possibility with writing down $\sqrt[3]{81} = \sqrt[3]{9^2} = 9^{2/3}$ (spontaneous example the illustrative that are simple). The teacher gives different example, namely $\sqrt[3]{5^2} = 5^{2/3}$ and $\sqrt[3]{2^5} = 2^{5/3}$. Then the teacher asked how to resolve if the cube root, cube root three were equal to the rank numbers is rooted, for example √ (8 & 3 ^ 8). Teachers give some examples the different based on the case raised by the student. Next, the teacher gives example spontaneous nature expansion of (expansive) as follows: a) $\sqrt[3]{8} = \sqrt[3]{2^3} = 2$, b) $\sqrt[3]{27} = \sqrt[3]{3^3} = 3$, and c) $\sqrt[3]{125} = \sqrt[3]{5^3} = 5$.

IV. DISCUSSION

In this study, 2 (two) characteristics spontaneous example in the learning process of mathematics. Two of these findings, namely klarifikatif and illustrative. However, in the presentation of illustrative appear spontaneous example in its nature: simple, equivalent, and expansion of (expansive). Clarification is spontaneous example settlement with classifies these examples, where teacher explains or review the completion of the sample. Illustrative is a spontaneous example by illustrating completion of these examples, where teacher explains and gives examples a different its nature is simple, equivalent, and expansion of (expansive). Spontaneous examples illustrative that its nature simple, the teacher gives some examples of more simple rather than previous example. Spontaneous examples illustrative its nature equivalent, the teacher gives several examples that equivalent the previous example. While the spontaneous examples its nature illustrative expansion, namely the teacher gives some example which is the expansion of some of previous example. In the presentation of the material the learning process mathematics in the classroom, teacher provide more spontaneous illustrative example. Examples given are examples that have arisen from the mind teacher spontaneously, then the teacher provides the spontaneous example illustrative its nature simple, equivalent, and expansion of (expansive).

Consideration teacher gives spontaneous example such, like example the rank fractions described above that begin with the rank positive or rank actual. Because it later when the they already know that 2^3 value is 8 then later on given 2^{-3} they will be confused, I say to the students that the rank of negative was converted into $1/_?$. Then where the difference between 2^3 with 2^{-3} in integer with fractions. My commence not with the process, but the outcome, eg $2^{-2} = 1/_4$, $3^{-2} = 1/_9$. Similarly, that in presenting the examples I was begin with 2^3 instead of I began to 2^{-3}, possibly she was confused. Hence can be seen that the rank of positive outcome integers, but if the rank of negative numbers into fractions but there remains number 8. If I am developing further, eg 3^2 outcome 9, and 3^{-2} outcome $1/_9$.

Use of many examples in the learning process is generally recognized to be important aspect and embedded most teaching mathematics (Atkinson et al, 2000; Bills et al, 2006; Carpenter, 1989; Mason, 2006; Stein et al, 1996; Zaslavsky, 2010; Zodik dan Zaslavsky, 2008). Examples are integral part of mathematical thought, learning and teaching, with particular regard to conceptualization, generalization, abstraction, argumentation and analogical thinking (Zodik dan Zaslavsky, 2008, hal. 165). Similarly, Bills et al (2006) argues that use of many examples inside have an impact of learning on the learner, ie have good reasoning and capability solving.

In the process of the thinking interaction in learning, according Vygotsky, there are two important principles in interactions (the thinking interaction), namely (1) regarding function and importance of language in social communication that begins the process of pencaderaan to sign until to exchange information and knowledge, and (2) Zone of Proximal Expansion (ZPD). Teachers as mediator has the role of and bridge the encourage students in their efforts build knowledge, understanding and competence. According the theory of Vygotsky, cognitive functions of humans derived from social interaction of each individual in a cultural context. Vygotsky also convinced that learning occurs moment students work handling tasks that have not be learnedhowever these tasks are still within range of capabilities namely the are within Zone of Proximal Expansion (ZPD) their. ZPD is the area between the actual expansion level which is defined as the ability solve problems independently with the level potential expansions were defined as problem solving skills under guidance of adults or their peers who are more capable.

V. RECOMMENDATION

In this research only limited to the certain areas of material, ie one subject (the rank fraction) in the field of algebra. It is therefore, as ingredients for expansion subsequent researchers were want to conduct research, relating to the thinking interaction of teachers and students in of spontaneous example learning of mathematics, should review or developing on the other subject matter on the field algebra or geometry fields.

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