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# The Formation of Spontaneous Example by Novice Teacher and Experienced Teachers in the Practice of Mathematics Learning

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***Abstracts:*** *The formation of spontaneous examples in mathematics, is the teacher's responsibility and is challenging and requires a lot of consideration. The spontaneous example is important to mathematics because they can develop the mindset of teachers and students. Examples of spontaneous influenced by experience in the learning process. The purpose of this study is to explore the process of formation of spontaneous example by novice teachers and experienced teachers. This research was conducted through observation in a math class on novice teachers and experienced teachers and with interviews with both. The results showed that spontaneous examples made by novice teachers could be generated from the material explanation. The spontaneous examples from experienced teachers are formed in two ways, namely from the material explanation and from student's responses to earlier spontaneous examples. Spontaneous examples generated by experienced teachers can be seen as stratified.*
***Keywords:*** *novice teachers, examples of spontaneous, classroom, observation, experienced teacher*

## I. Introduction

In the learning process, the teachershave to master learning materials that will be given to students. When students will construct a concept that will be constructed from material that is taught by teachers, students are able to interact with teachers to solve a problem. On this interaction activities between teachers and students occur an interaction process of thinking, in solving the problems appropriately.

Interaction of thinking process is inseparable from the use of examples in the learning process. The use of examples in the classroom is an integral part of teaching mathematics that has a great influence on student learning. According to Zaslavsky (2008) stated that a good examples in learning as one of the teachers to communicate the target objectivesof learners. It certainly indicates that it is important for teachers to be able to select or construct examples that appropriate to the learning objectives expected.

In choosing and producing examples in teaching, a teacher is often requiredto make decisions in the classroom during the actual learning process. Making decisions on how to provide examples that will assist student learningdraws on the teachers' understanding of how students are able to construct new knowledge.

In this research, I study how teachers construct spontaneous examples to assist student learning. Spontaneous examples are usedwhen students do not understand the material being taught by the teacher, when students make mistakes, when students discuss and their understanding of different concepts, or perhaps when students respond to the teacher's explanation. Zodik & Zaslavsky (2008), suggested that a spontaneous examplesoften occur in situations where teachers have a clear plan for a lesson, but no specific examples.

Spontaneous examplestudied in this research are examples used in the learning of mathematics. Such examples appear spontaneously caused by certain conditions, such as, responseto students'questions and where the example given by the teachers was not previously designed or planned.

Based on the results of initial observations with eight teachers in the process of mathematics learning in the classroom, it became apparent that not all of them can generate spontaneous examples in teaching practice. Teaching experience greatly affects the use of spontaneous examples. Experienced teachers use more spontaneous examples than novice teachers in teaching practice. Similarly,experienced teachers use a greater variety of spontaneous examples thannovice teachers. According to Muñoz & Chang (2008) more experienced teachers are increasingly effective in teaching. Jennifer (2010) also suggests that the greater the experience of teachers the greater their effectiveness and productivity.

The purpose of this research is to explore the formation process of spontaneous example by comparingnovice teachers withexperienced teachers in mathematics teaching practices in the classroom.

## II. Research Methodology

This research is classified as descriptive research and employs a qualitative case study approach. To explore the formation of spontaneous exampleswe conducted systematicobservations of mathematics teaching in the classroom, The research was conducted with two (2) qualified mathematics teachers both with undergraduate degrees (Mathematic EducationOne teacher was a novice teacher with 5 years' experience, while experienced teacher had 20 years teaching experience. Observations were conducted two different school settings (Junior High School).

The observation was conducted in class VII for novice teacher and class IX for the experienced teacher.Each teacher teaches3 meetings with time allocation 2x40 minutes of each meeting. Math materials that were selected for this researchinvolved the subject of fractions in class VII,including: the concept of fractions and fractions, changing the form of fractions, and the sum of fractions. In class IX the materials involved the subject of fraction exponential number, and distribution to the exponential number.

The teaching sessions were recordedto captureeach teacher's use of spontaneousexamples.We then recorded interviews with the novice andexperienced teachers. As teachers were interviewed the recording of the teaching processand use spontaneous examples was replayed.

## III. Findings And Discussion

From the observationsthe researcher identified 94 examples and 4 non-examples - 66 spontaneous examplesand 28 plannedexample used for thesix sub-subjects, namely the concept of fractions, fractions, changing the form of fractions, the sum of fractions, fraction exponential number, and distribution of the exponential numbers.

The novice teacher is identified as GP, the experienced teacher, is identified as GA.GP generated more spontaneous examples in the learning process of mathematics, than GA. However, the spontaneous examples produced by GA were more varied than the spontaneous example generated by the GP.

### 1. The Formation of Spontaneous Example at the Novice Teacher

During the process of mathematics learning in the classroom, GP explained the material of fractions concept and fractions, fractions change models to models of other denominations, and the sum of fractions.

When the GP explained the concept of fractions and then tested the students' understanding of the meaning of fractions, there were some students who understoodfractions are fragmentary, butdid not understand fractions as a whole. This was revealed in therecorded transcriptsof teaching practices in the classroom, as follows.

GP:What is the fraction?
S1:Numbers that have a numerator and denominator.
GP:Yes, a number that has a numerator and a denominator, others?
S2:Numbers can be divided, Sir
GP: Well, the numbers can be divided, let the other?
S3: Numbers can be simplified.

Based on the dialogue above, some students mentioned the definition of fraction in accordance with his views. Definition of fractions mentioned by the student, just to mention the most of the characteristics of a fraction. GP then showed examples $\frac{5}{3}$ (SpontaneousExample)then asked to students, "whether $\frac{5}{3}$ is fraction?"there seems to be students (S4) who answered "no", the reason being the numerator is greater than the denominator. This means the student in mind, a fraction the numerator should not be more than the denominator. The next example is shown GP, namely $\frac{6}{2}$ (non-example). When the GP asked "Whether $\frac{6}{2}$ fraction or not?"some students answered "no", and some answered "fractions". One of the students (S2) emphatically answered "fraction, Sir". This showed that in mind of S2, as well as mention that fractions are numbers that can be divided. So, in the thoughtsof S2, when the number in the denominator can be divided by the number of numerator then that is a fraction.

By looking at both cases (condition) above, GP when through a process of clarification of both these examples to explain the definition of fractional, stressing that there are three (3) things that need to be understood at a fraction, namely $\frac{a}{b}$ , with each of a and b is an integer; b ≠ 0; and b is not a factor of a.Further explain that $\frac{5}{3}$ is a fraction because it meets all three of the above, namely $\frac{5}{3}$ fulfill $\frac{a}{b}$, 5 and 3 respectively integers, and 3 is not a factor of 5. Whereas $\frac{6}{2}$ is not a fraction because 2 is a factor from 6and $\frac{6}{2}$ its result is 3 which is integers, although the valid or fulfill $\frac{a}{b}$ and respectively 6 and 2 integers.

In changing the form of fractions, GP explained that there are 12 concepts that must be understood model of the pieces. GP explained each model fractions were converted to other fractional models, accompanied by spontaneous examples. To determine the ability of students' understanding toward 12 concepts above, GP selected example (planned example) recurring decimal fraction 2.33333333 converted into common fraction. Furthermore, GP explained the example as Figure 2 below.

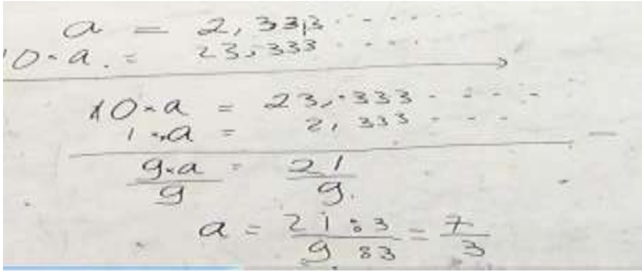


**Figure 2.** The Illustration process as example of fraction

When GP explained examplesabove, some students had trouble in understanding completion or illustrations used by GP. SoGP then gave a further example, i.e. a spontaneous example. The example in question is a recurring decimal fraction 5.666666666 converted into common fraction. GP then asked one student (S2) to complete the example. S2 resolve these examples like Figure 3 below.

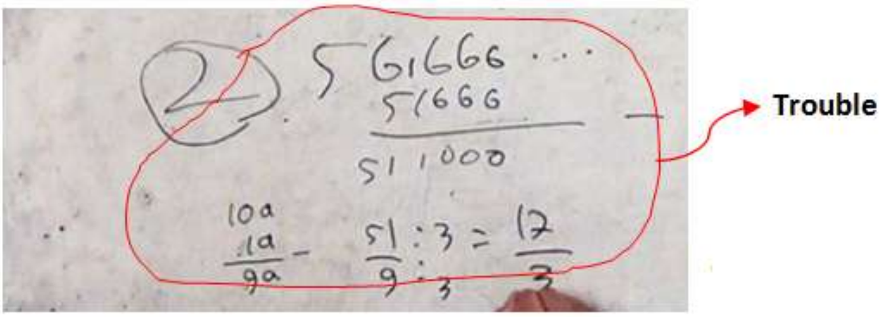



**Figure3.** The Process of spontaneous example completion by S2

The completion made by S2, indicated that she/he did not understand the procedure to change a recurring decimal fraction to a common fraction, although in S2's mind that the results are the same. This case happened to trouble S2, so GP clarified the completion using spontaneous examples (shown Figure 4 below).

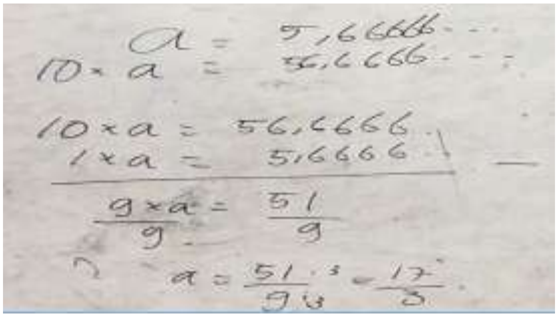


**Figure4.** Clarifying spontaneous example of fraction

GP nextexplained the material of addition and subtraction of fractions. The material is a continuation of the material that has been discussed at previous teaching meetings. Before GP explained the operation of addition and subtraction of fractions, GP firstly explained the four natures of the addition of fractions, namely commutative, associative, identity, and closed. Discussion on the four natureswas accompanied by a spontaneous example for each.

When GP illustrateda spontaneousexample, no response or feedback from the students was forthcoming, so GP did not show other examples related to the addition of fractions. However, when GP explained the operations of addition fractions by showing spontaneousexamples $\frac{2}{5}+\frac{3}{4}=?$, One of the students (S2) did procedural errors in completing the fractional operation. S2 completed as follows : $\frac{2}{5}+\frac{3}{4}=\frac{6+8}{20}=\frac{14}{20}$.

S2 thought that after the commission of the denominator of the two fractions are obtained, then divided by the denominator of each fraction, and then summed (it is supposed to be multiplied) as the numerator. As a result of the *trouble*experienced by S2, GP clarified the completion by use of spontaneous examples to illustratethe process (Figure 6 below).

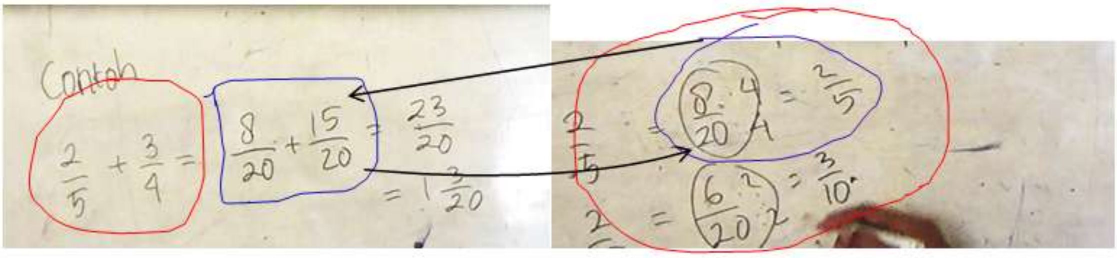



**Figure6.** The Illustration of spontaneous example in addition of fraction by GP

GP explained that to add two fractions, one way to do it is to look for how each fraction were valued in order to add up the two fractions. Furthermore, so that students can more easily understand fractions addition procedure, GP provided a further spontaneous example $0, 8 + \frac{3}{5}$. GP explained that in its decimal fraction form (0.8) we change to a common fraction first, then do the process such as the completion of these examples (meaning $\frac{2}{5} + \frac{3}{4}$)

The next example is a planned example (selected from the textbooks), to specify the addition in decimal fraction: $\frac{5}{10} + \frac{4}{20} + \frac{3}{30} + \frac{2}{40}$ =?.However, there are students (S1) that asked "How to determine the denominator, sir?". GP respond to questions of S1 and recalls that to add fractions in the example above, firstly we do a simplification of the individual fractions thereof. Then specify its *Least Common Multiple*. The next process, is to do the addition of fractions, then the results change to decimal fractions. It was also explained that in fact there are many ways that this it can be done, may also be used to change the decimal fractions, as did the addition in decimal, which has been obtained. Furthermore, GP did the illustrations for the addition of the fractional completion by simplifying the fraction first (Figure 7 below).

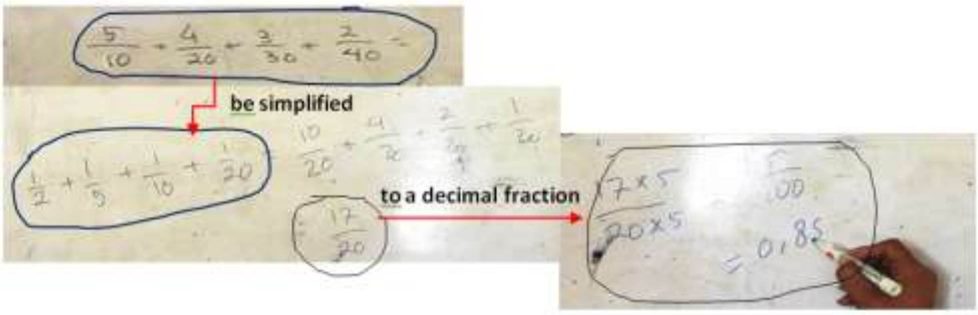



**Figure 7.** Illustrative examples of spontaneous summation fractions in decimal fraction by GP

**2. The Formation of Spontaneous Examples by an Experienced Teacher**

When GA explained the natures of the exponential number of fractions, GA did not explain the requirements that apply to these properties. Thus, in the minds of students what is described by the GA, is considered valid (Figure 8 below).

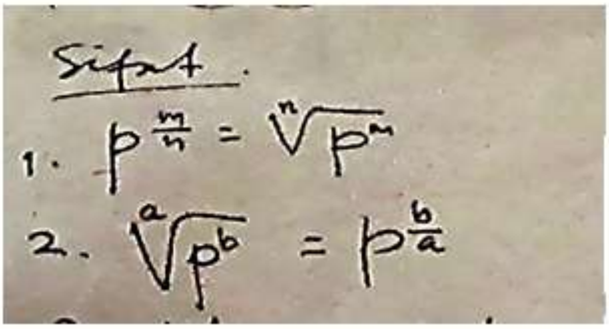


**Figure 8.** Discussion properties fraction exponential number by GA

Furthermore GA gives spontaneous examples of simplify $9^{\frac{4}{5}}$. The example discussed with Figure 9 illustrates as follows.

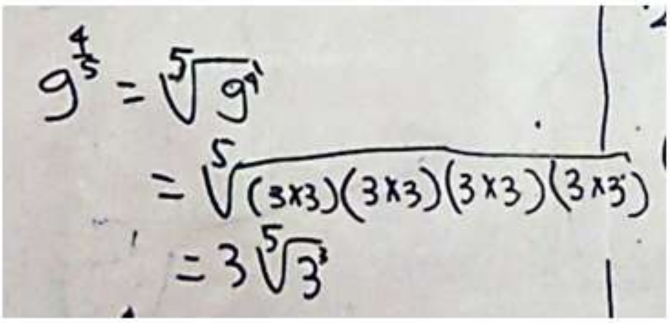
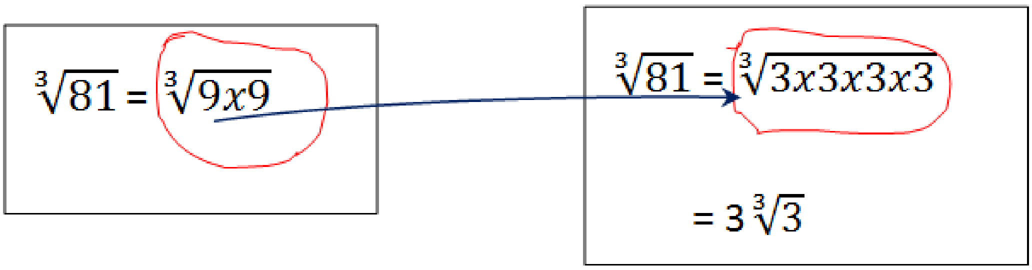



**Figure9.** Illustrative examples of spontaneous fraction exponential number by GA

As the spontaneous were discussed (illustrated) by GA, one student (S1) asked "wherewas 3 from?" (Meaning 3 on $3\sqrt[5]{3^3}$). S1 experiencing anobstacle to understanding the process of completion above. GA explained that $9^4$ the roots can be described $9^4$ = 9x9x9x9 = (3x3)(3x3)(3x3)(3x3), because the number 3 as many as eight (beyond the exponential root) then there is one number 3 issued from the root (representing five number 3 in the roots), the remaining three numbers in the roots as the square root of the number 5, so obtained (writte) $3\sqrt[5]{3^3}$.

Furthermore, GA then gavea spontaneous example of simplify $\sqrt[3]{4^2}$, with the hope S1 was able to understand the concept of fractional exponential number. The examples discussed (illustrated) GA, and noted that it is obtained through the same process above, $\sqrt[3]{4^2} = \sqrt[3]{(2x2)(2x2)} = 2\sqrt{2}$. It seemed that there were still students who have obstacles in understanding the process of completion, despite being given two relevant examples.*Trouble* for these students involved outlining the number raised to the square root. To overcome trouble in students, GA generated subsequent spontaneous examples forsimplify $\sqrt[3]{81}$. The examples discussed (illustrated below) GA as follows.




GA explained that it can be described 81 = 9x9, because 9 cannot be removed from the roots it can be described again 81 = 9x9 = 3x3x3x3so 3 may be removed from the dubroots. Because the rest is the number 3 in the roots of the obtained $3\sqrt[3]{3}$. GA's explanationabove, addressed a claim by one of his students (S2). S2 claimed that the answer above ($3\sqrt[3]{3}$), was not in accordance with the applicable properties ($\sqrt[a]{P^b} = P^{\frac{b}{a}}$). In the mind of S2, if known to the rank and the root of the result (the answer) is the fraction exponential number. Furthermore, GA in responding to S2's claim,explained that there are several ways that can be used to resolve $\sqrt[3]{81}$. GA explained and illustrated the two ways, as follows: (1) procedure 1: $\sqrt[3]{81} = \sqrt[3]{3x3x3x3} = \sqrt[3]{3^4} = 3^{\frac{4}{3}}$ ; and (2) procedure 2 : $\sqrt[3]{81} = \sqrt[3]{9^2} = 9^{\frac{2}{3}}$.
After GA provided the spontaneous example above, one student (S2) asked the question "what if the roots are the same rank with the rank numbers in the roots?" S2 wrote on the chalkboard an example $\sqrt[8]{3^8}$. GA responded to questions of S2, and explained that if the rank of the same root with the rank numbers in the root then the result is a number that is raised to the roots. Furthermore GA gave S2 three spontaneousexamples similar and relevant to the written examples. For example (1) $\sqrt[3]{8}$, the square root can be converted into $\sqrt[3]{2^3} = 2^{\frac{3}{3}} = 2$. Example (2) $\sqrt[3]{27}$ can be converted into $\sqrt[3]{3^3} = 3^{\frac{3}{3}} = 3$, and example (3) $\sqrt[3]{125}$can be converted into $\sqrt[3]{5^3} = 5^{\frac{3}{3}} =$ 5.

Furthermore, when GA discussed the material division of the exponential number this was accompanied by a spontaneous example which explained that the division of the exponential number valid properties:$\frac{a^m}{a^n} = a^{m-n}$ , for a is an integer and$a \neq 0$,then$m$and$n$is integers. Some simplespontaneous examples were produced by GA on the discussion of such materials, e.g. (1) $\frac{2^5}{2^3}$; (2) $\frac{4^7}{4^4}$ ; and (3) $\frac{-7^5}{-7^4}$. The discussion is based on the example of the nature of the force; this did not become an obstacle for students. However, after GA explained to S3 the example above, one student asked (S3) "what if the rank is on the negative and positive under?" GA responded to S3's questions by explaining that powers of numbers above (i.e. the numerator) and powers of numbers below (i.e. in the denominator) could have been the number is negative and the gave further spontaneous examples, i.e. $\frac{5^{-3}}{5^2}$. Then the sample is illustrated as follows: $\frac{5^{-3}}{5^2} = 5^{-3-2} = 5^{-5}$.Furthermore, students (S2) asked, "what if the divider and divided each raised to again? ', S2 write on the chalkboard $\frac{((-7)^2)^2}{((-7)^2)^2}$(Example in question). GA responds to questions of S2 and answers that the material covered (in accordance with the nature of the distribution of the exponential number) has not reached these examples. But GA illustrates that these examples could be revised in accordance with the nature $\frac{a^m}{a^n} = a^{m-n}$, so that $\frac{((-7)^2)^2}{((-7)^2)^2}$into$\frac{-7^4}{-7^4}$ = $(-7)^{4-4}$ = $(-7)^0$. Next GA gave similar spontaneous relevant examples $\frac{(-7)^3}{(-7)^3}$ = $(-7)^{3-3}$ = $(-7)^0$.

## IV. Consideration Of The Establishment Of Spontaneous Example

In discussing the concept of fractions and fractions GP raised many examples both planned examples largely taken (selected) from the textbooks and spontaneous examples generated out of the material explanation. When GP explains the material concept of fractions, most of the examples discussed are spontaneous examples. Some of the simple spontaneously generated examples, used by GP helped instill the concept of fractions, although there were still students who had problems (trouble) understanding the concept of fractions.

Consideration of GP's provision a simple spontaneous examples when discussing the material of fractions concept suggest that the examples are mostly repetition of examples students were provided in elementary school, only recalled if the student is still considering the material or not. Similarly, when GP explained the matter of changing the denomination of 12 models to models of other denominations, GP provided spontaneous examples of how each model fractions will be converted to other fractional models.. The examples are sorted into levels of difficulty, such as changing the shape of decimal fractions to the mix, giving first the simplest example then moving to somewhat more complex examples. Consideration GP use of spontaneous examples shows a process of trying to find out whether students can understand the material or not.

Furthermore, GP provides examples of repetitive fraction 2.333333333, the sample is taken from the textbooks. But the explanation ofGP is somewhat different with discussion in the textbook. Discussion of these materials is still difficult to understand bymost students, this is the case for example, or a matter of changing decimal fractions are often completed by students only on the benchmark 2 decimal places or frequent use of the decimal point or two decimal places. GP thought that how decimal fractions over 3 to 4 digits behind the comma, there is no problem, or can simply be solved by the students.

When some students have problems understanding the discussion of decimal fraction 2.333333333 converted into fractions mixture, GP gave spontaneous examples next 5.666666666 to be changed to a common fraction. Consideration of GP's spontaneous examples shows that examples were rarely given about using 4 decimal, 5 decimal and onwards. Students rarely askedfor such examples. Questions are often asked about 2,3; 4,55 for example, so that the students' understanding just ends there. When the students got a composite question from several materials, students had difficulties in finishing.

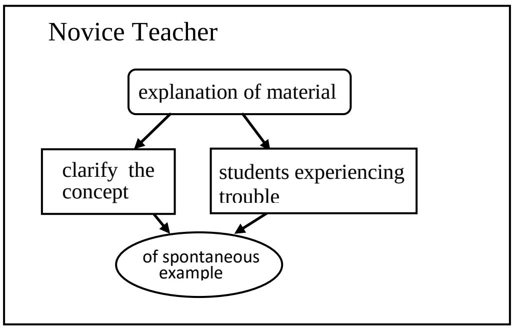
In the discussion of the additional fractions, some students just focused on what should be equal for denominator, when given examples or different about them getting confused. These students have learned the material of FPB and the *Least Common Multiple* and know to add fractions back on the material of*Least Common Multiple*, so that the fractional denominator is same. Consideration of GP's simple spontaneous example $\frac{2}{5} + \frac{3}{4}$, to see a concept of denominator originally how to add fractions are not the same, so that when the example can be resolved, the student is not confused anymore when completing the addition of several denominators that are not the same.

Material discussion of fraction exponential number by GA, generated many spontaneous examples. The formation of the spontaneous example, consists of two ways, namely (1) spontaneous example resulting from material explanation, (2) a spontaneous example to student responses. So spontaneous examples can be stratified. When the GA discuss the material with spontaneous examples simplify $9^{\frac{4}{5}}$ and accomplishing $9^{\frac{4}{5}}$ = $\sqrt[5]{9^4}$ = $\sqrt[5]{(3x3)(3x3)(3x3)x(3x3)}$ = $3\sqrt[5]{3}$, due to some students have problems in understanding the material, so that the resulting sample subsequent spontaneous $\sqrt[3]{4^2}$ = $\sqrt[3]{(2x2)(2x2)}$ = $2\sqrt{2}$. Consideration of GAs spontaneous formation of two examples shows this is undertaken because they already know or understand the properties of the exponential number of fractions, and the further example improves the quality of students thinking, encouraging them to improve their understanding on the fraction exponential number. So once students are given another example, students already know how to process. It was to be expected, so that students are able to solve problems in their daily lives.

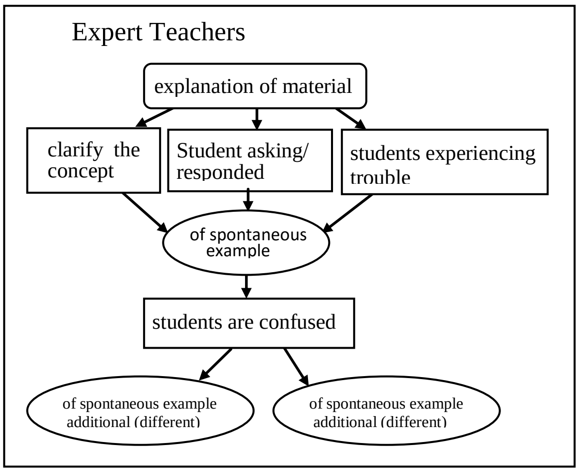
Furthermore, when the GA discussed spontaneous examples simplify $\sqrt[3]{81}$, there was a claim from a student. In the mind of the student the example is not in accordance with the GA's discussion of the properties fraction exponential number previously discussed. GA explained that $\sqrt[3]{81} = \sqrt[3]{9x9} = \sqrt[3]{3x3x3x3} = 3\sqrt[3]{3}$. But the discussion of GA did not match the minds of students because his understanding is different from the students regarding the properties of fraction exponential number. So from the students' claim GA formed a new spontaneous example.GA formed another spontaneous example $\sqrt[3]{81} = \sqrt[3]{3x3x3x3} = \sqrt[3]{3^4} = 3^{\frac{4}{3}}$ (According to the nature fraction exponential number) and subsequent spontaneous examples $\sqrt[3]{81} = \sqrt[3]{9^2} = 9^{\frac{2}{3}}$ (According to the nature fraction exponential number). Considerations of GA spontaneous example show it was formed toprovoke students to ask questions, because the actual settlement $\sqrt[3]{81}$may be done in many ways. It also has something to do with the national exam, because the national exam there are no multiple correct answers and what is sought is the correct answer. So if students only know one way only, then he or she is likely to face a problem. Indeed, the students are encouraged to think critically about the problems encountered.

Furthermore, when the GA discussed the materials of exponential number division, many more spontaneous examples were provided. Consideration of the spontaneous examples provided by GAshow that giving examples is not fixated on text book material because textbook it is sometimes difficult to find direct and relevant examples. Relying on textbooks for examples does not encourage students make examples by themselves about what it is they want to learn, also if a sample was taken from the book it is not necessarily remembered, and the mathematical operation that is illustrated less embedded in the students' thoughts.

Structure formation of spontaneous example by novice teachers and experts teachers can be illustrated in Diagrams 4.1 and Diagrams 4.2 below.




**Diagrams 4.1**. Structure formation of spontaneous examples novice teachers




**Diagrams 4.2**. Structure formation of spontaneous examples expert teachers

## V. Conclusion

The use of examples particularly spontaneous examples in mathematics learning in the classroom is an integral part of mathematics teaching practices and have a great influence on learning.

In the novice teacher's teaching practice (GP)gave more spontaneous examples learning process but these appeared to be repetitious of earlier used learning materials. The more experienced teacher (GA) generated spontaneous examples that are more varied. GA's spontaneous examples are generated from the learning process, and when there is a claim or response from the students'GA spontaneously generated new example so that spontaneously generated examples are stratified by degree of difficulty. In the process of the formation of spontaneous example, GA provoked more students to ask questions, this is done to encourage students to develop thinking process.

Experienced teachers are different fromnovice teachers as they have gained expertise through real-life experience, the practice of teaching and learning, and time. According to Stronge (2013) experienced teachers are also effective as experts who have mastered the content and get to know the students they teach, using strategies for efficient planning, practicing decision-making, interactive, and realize the skills for effective classroom management, Furthermore, Stronge (2013) suggested that teachers who are experienced and can effectively and efficiently do more things in a shorter time than can be done by novice teachers.

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