LEARNING THERAPY FOR STUDENTS IN MATHEMATICS COMMUNICATION CORRECTLY BASED-ON APPLICATION OF NEWMAN PROCEDURE (A CASE OF INDONESIAN STUDENT)

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ABSTRACT

As students of Mathematics Education Study Program, the ability to do exercises, do the exam, or presenting a mathematical problem solving is a must. What has been done and written by the student, will obviously involve other people to read it. The result of doing exercises, may be read by classmates. The results of the test will be read by the lecturer, present the solution of the mathematical problems, will be heard by classmates or the lecturer. Therefore, the ability of a student reads the problem, understands the meaning of the problem, is able to writes what is known and what is being asked, is able to determines the formulas that will be used appropriately, based on the formula to calculate or accurately perform arithmetic operations, and the ability finds the answer correctly, it is required by each student. Newman procedure, can be utilized to determines the types of student errors in doing math problems in writing. By knowing the types of student errors in doing math problems, then the lecturer can gives the Learning Therapy so that the students can become true and accurate in communicating ideas through writing solutions.

Key Words: Newman Procedure, Learning Therapy, Mathematics Writing

1. Introduction

Ability to presents and writes mathematical ideas or does of math problems are required by a student as a math teacher candidate. As students of Mathematics Education Study Program, the ability to do exercises, do the exam, or presenting a mathematical problem solving is a must. What has been done and written by the student, will obviously involve other people to read it. The result of doing exercises, may be read by classmates. The results of the test will be read by the lecturer, present the solution of the mathematical problems, will be heard by classmates or the lecturer.

If a student as a teacher at the future time, then the teacher's ability to explain the completion of math problems to the students is absolutely necessary. Teachers should train students so that

the students are able to read the mathematics problems, able to grasp the meaning of problem, and finally the teacher is able to demonstrate his/her work on the board so that students increasingly clear.

Issues to be discussed in this paper are as follows:

1) How does the steps of Newman procedure to detect the type of mathematical problem solving errors committed by the student?
2) Is Newman procedure can be added so that it can be used as a tool of identifying the type of other types of errors?
3) How to train the students so that after it is detected in the types of errors students do math, then the teacher can improve the quality of student answers, so that the students can avoid mistakes as much as possible?

2. Utilization Newman Procedure

Newman procedure, often used and applied in many countries and it is utilized to determines the different types of errors that the students in doing math problems.

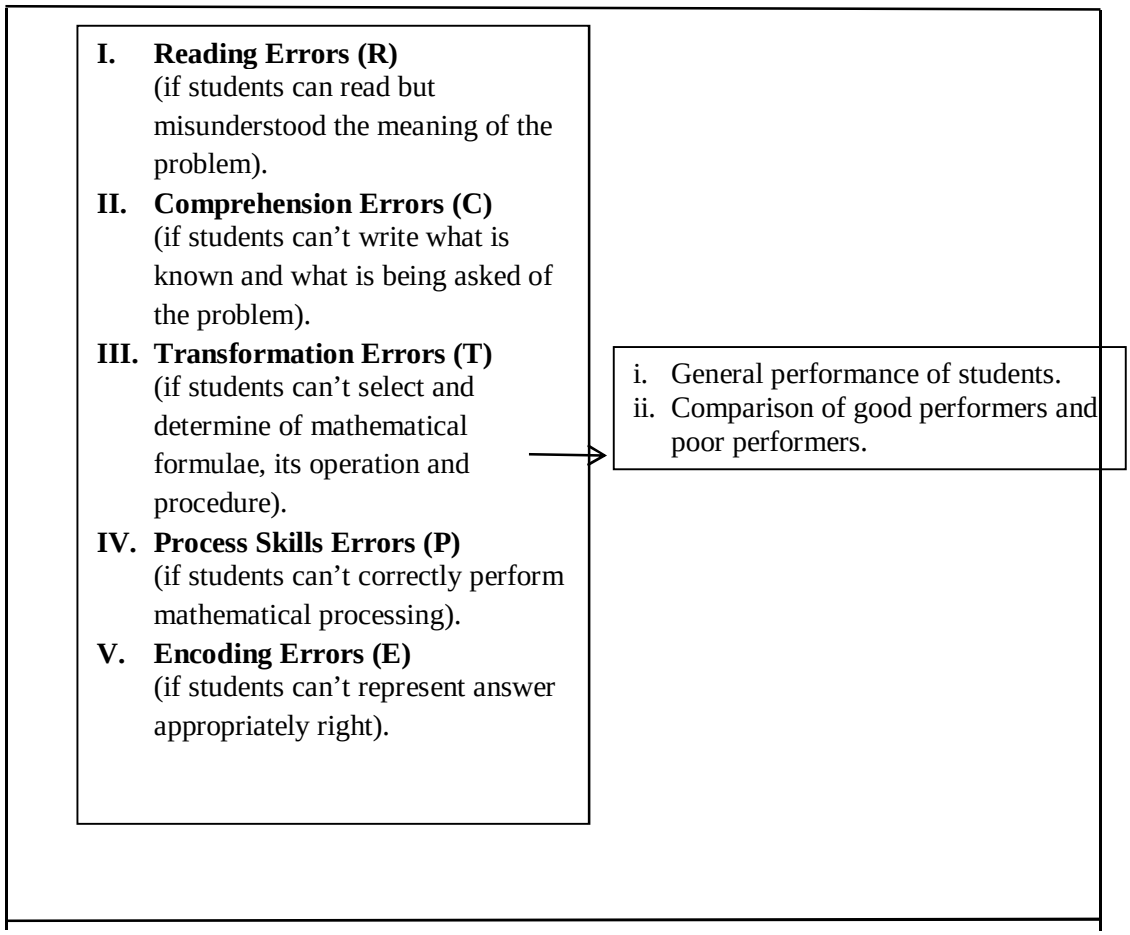
In solving math problems, especially in the form of a description and nature of literacy, mistakes should be avoided as much as possible. Hofer and Beckmann (2009), said that: Mathematical literacy is an individual's capacity to identify and understand the role that mathematics plays in the world, to make well-founded judgements and to use and engage with mathematics in ways that meet the needs of that individual's life as a constructive, concerned, and reflective citizen. To be able to do the problems, Dahlin, B & Watkins, D (2000) asserted that: "The understanding is more likely to lead to high quality outcomes than memorizing". Related to mathematics learning, teacher should encourage students try to do math carefully, including through the inquiry/ investigation. Wachira, Pourdavood, and Skitzki (2013) wrote that: Mathematics instruction should provide students opportunities to engage in mathematical inquiry and meaning making through discourse, and teachers should encourage this process by remaining flexible and responsive to students' response and feedback.

In mathematical learning, learning in depth and avoiding mistakes is needed. On the other hand, the repetition of material for students who are weak are also required. Although, Marton, F & Saljo, R (1976) wrote that "in mathematics education, there has been tension between deep learning and repetitive learning". Furthermore reaffirmed that "In western culture repetitive learning is often positioned as the opposite of deep learning and understanding." In math learning, students need to understand the material. Not only are memorized, so that students avoid mistakes. Lie, S (2006) also wrote that " Western educators emphasise the need for students to construct a conceptual understanding of mathematical symbols and rules before they practise the rules." Watkins, D & Biggs, J.B (2001) also does not agree that learning mathematics is dominated by rote activities . They argue that "One aspect of the criticism is that rote learning is known to lead to poor learning outcomes".

The cause of the student errors in solving mathematical problems, especially subjective problems of Discrete Mathematics will be discussed in this paper. The studies based on sequence analysis of the error using Newman procedure. Newman procedure in the search for the types of

error in the student's work on the problems seen are worldwide because it has been applied and utilized in many parts of the world such as India, Malaysia, Thailand, Australia, and so on. Here we will discuss about the Newman procedure in finding the cause of the error of the students in working on math problems. Although, to be able to find the type of error should be done in a friendly and polite interview. The need for civility in this interview is also strengthened by Chien (2013) that "politeness strategies are diversely used in interviews". Affirmed by DiCicco-Bloom & Crabtree (2006) that the task of the interviewer is to obtain information, listen to, and encourage the interviewee so that they can speak honestly.

From the writings of White (2005), Singh, Rahman, and Hoon (2012), Jha (2012), Prakitipong and Nakamura (2006), the standard Newman Procedure has 5 steps. It can be concluded that the types of Newman Procedure to determine the errors of students after solving math problems are as follows:



Questions can be posed to the students, among others, are as follows:

I. Reading level: Can the students read and understood the meaning of the problem?
II. Comprehension level: Can students write what is known and write a given question?
III. Transformation level: Can the students select and choose the appropriate mathematical formulae, operations, or procedures?

(Transformation from linguistic understanding to mathematical interpretation).

IV. Process skills level: Can the students perform the mathematical calculation or the procedure accurately?
(Execution of mathematical processing).

V. Encoding level: Can the students represent the answer appropriately? (Representation of results from mathematical processing).

Finding the types of error based-on Newman procedure above can be obtained through an interview by a familiar and polite. Satiti (2014) had been reported in her Final Project that grade 8 of students of SMP 2 Ungaran - Indonesia has five types of errors mentioned above in doing Geometry test.

3. Other Findings in the Revealing of Error Types Based-on Newman Procedure

Based on the results of the preliminary study, Suyitno (2012) found the fact that there were seven types of errors who experienced by the students in doing Mid Semester exam on Discrete Mathematics. The seven types of such errors, five of which are the same as the type of errors that were obtained by Newman Procedure. Therefore, the two types of errors by the author are called: Other/additional findings in the revealing of error types based-on Newman Procedure. One type of error, according to the opinion of Jha (2012) which said that: "If student fail to get the correct answer in first attempt but succeeds in second attempt then the error would be classified as Careless Errors (coded as X)." And then, Clements (in Jha, 2012) stated that careless errors (X) as follows. "In Newman research a careless error has been defined as one which occurred even though the student knew (from a cognitive perspective) exactly how to gain a correct answer to the question at the time the incorrect answer was given and would be expected to give the correct answer when responding to the same question at some later time. Thus, if a student gave an incorrect response in the original whole-class test situation but then gave a correct answer immediately before the Newman interviews, then the interviewer would suspect that an X (Careless Errors) classification of the error might be appropriate.

The seven types of error and their examples in resolving this problem are as follows.

1) Language Errors (L)

The students do not master the language used to write the problems, particularly if the matter is bilingual.

For example:

Department of Mathematics Unnes will hold a National Seminar for teachers of mathematics. There are 6 speakers, each of the speaker will perform for one hour. If each speaker appears in different occasions, these activities would take too long. However, it is also not expected to have certain speakers who appeared at the same time. The seminar committee wants the seminar lasting no more than 4 sessions or 4 hours. How about the seminar is designed if speakers that should not appear at the same time, marked by ***** *in the table below.*

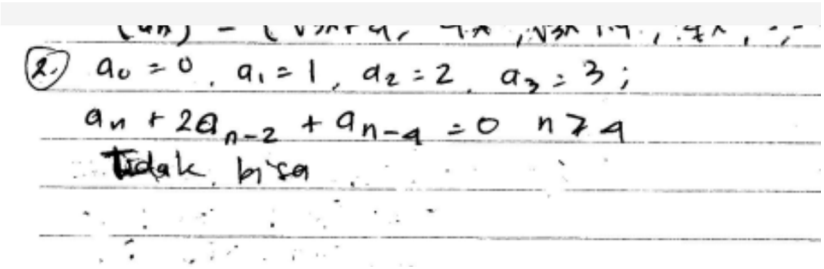
The name of speaker	*A*	*B*	*C*	*D*	*E*	*F*
A		*	*			
B			*		*	*
C					*	*
D						
E						*
F						

One of the students there who did not work on this problem. When a detailed interview, he said that failure to translate the problem above because mastery of English is weak.

2) Reading Errors (R)

The student can read but misunderstood the meaning of the problem.

For example:



At first glance, this student was able to write down what is known and also managed to write down what is being asked.

When a detailed interview, he said that:

(1) The student can read but misunderstood the meaning of the problem. He didn't know what the meaning of $a_0 = 0$, $a_1 = 1$, $a_2 = 2$, and $a_3 = 3$.

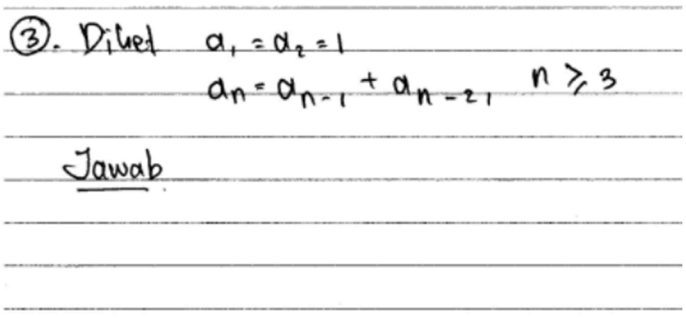
(2) write down what is being asked merely try;

(3) The next step, the student is also working with the accompanied opinions "are basically writing" so that received a value.

3) Comprehension Errors (C)

Comprehension Errors are occured if students can't write what is known and what is being asked of the problem.

For example:

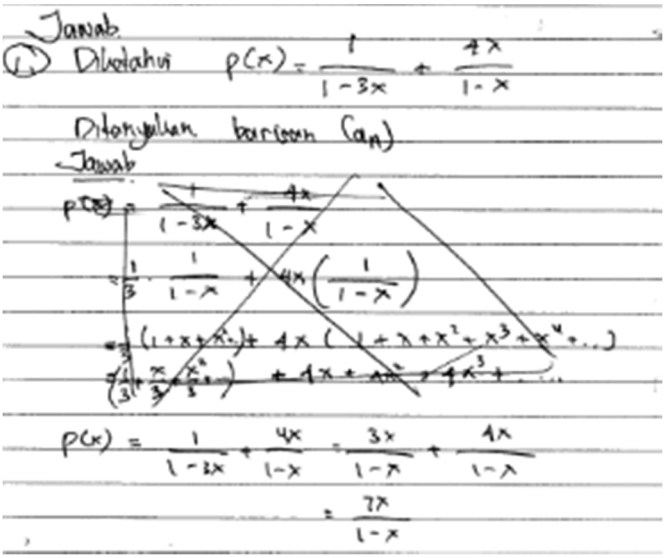


When a detailed interview, he said that: I can't write what is known and what is being asked of the problem.

4) Transformation Errors (T)

Transformation Errors are occured if students can't select and determine of mathematical formulae, its operation and procedure.

For example:

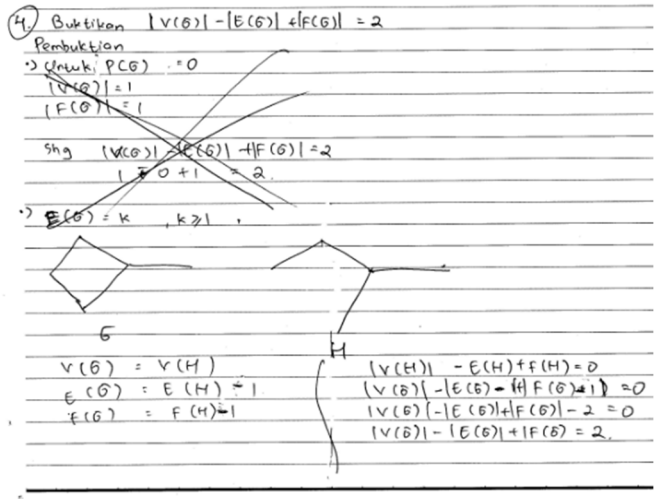


In interview revealed that student is not able to select and determine the mathematical formulas that will be used.

5) Process Skills Errors (P).

Process Skills Errors are occured if students can't correctly perform mathematical processing.

For example:



Student can write down what is already known, also managed to write down what is being asked , and the theorem is used to solve it is also true. However, when the student was interviewed it was revealed that the student:

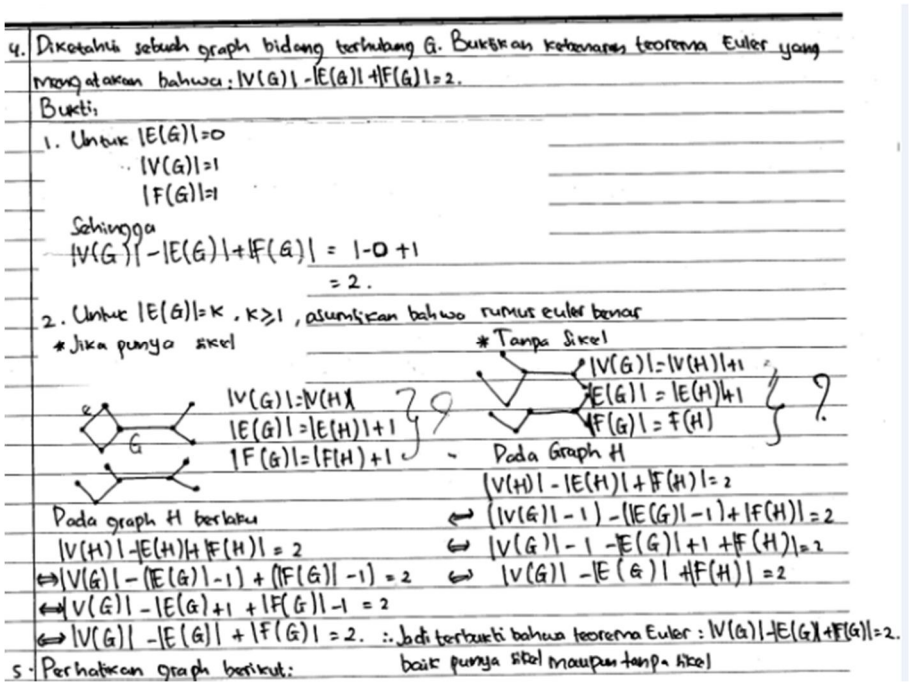
(1) Didn't manage to do the procedure for resolving this problem and the algorithm was wrong.

(2) As a result, the students failed to get to the stage of encoding process.

6) Encoding Errors (E)

Encoding Errors are occured if students are not able to show the correct answer and right.

For example:

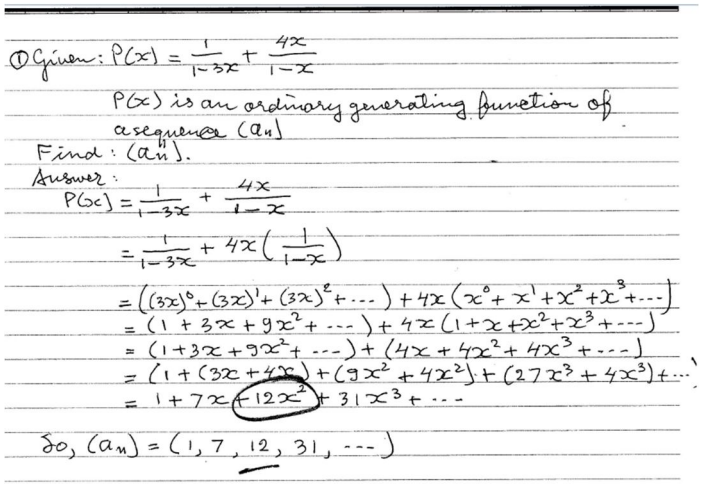


When the student was interviewed it was revealed that the student failed in last steps solution. So, this error type was called Encoding Error.

7) Careless Errors (X)

Careless Errors are occured if a student is careless, hasty, or ill-considered in writing the solution.

For example:



4. Learning Therapy

By knowing the types of errors made by students in solving math problems, then the teacher can provide a Learning Therapy so that students can be more confident and accurate in communicating ideas through written language correctly. Learning Therapy can be performed with acts such as: (1) Learning to understand the meaning of the problem through learning groups. (2) Often practicing solve the subjective problem in detail, correct, and reasonable.

5. Conclusion

The study in this paper, we can conclude the following things.

(1) The types of error are based on Newman procedures, the error type R, the error type C, the error type T, the error type P, and the error type E.

(2) Based on the results of the preliminary study, there were seven types of errors who experienced by the students in doing Mid Semester exam on Discrete Mathematics. Of the seven types of such errors, five of which are the same as the type of error that was obtained by Newman Procedure. Additional findings in the revealing of error types based-on Newman Procedure are the error type L, the error type R , the error type C, the error type T , the error type P, the error type E, and the error type X.

(3) In order to the students avoid mistakes do the subjective problem, lecturer can provide Learning Therapy by asking the students to learn in groups and often practice an mathematical subjective problem.

6. Recommendation

Recommendations can be given based on this preliminary study are as follows.

(1) In order for students as a math teacher candidates can seamlessly write settlement math problem correctly, then the prospective teachers need to be trained in order to avoid the various types of errors that may be made by them.

(2) Teachers/lecturers should give notes on the exam paper the students about the types of errors that are made to the student concerned immediately realize the fault location and the type of errors that happened.

(3) This type of error can be extended by observing student work products who delivered orally mathematics.

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