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# PROCEEDING

## LANGUAGE DEVELOPMENT ISSUES & THE CHALLENGES OF GLOBAL ECONOMY, SOSIO-CULTURE & INDUSTRY

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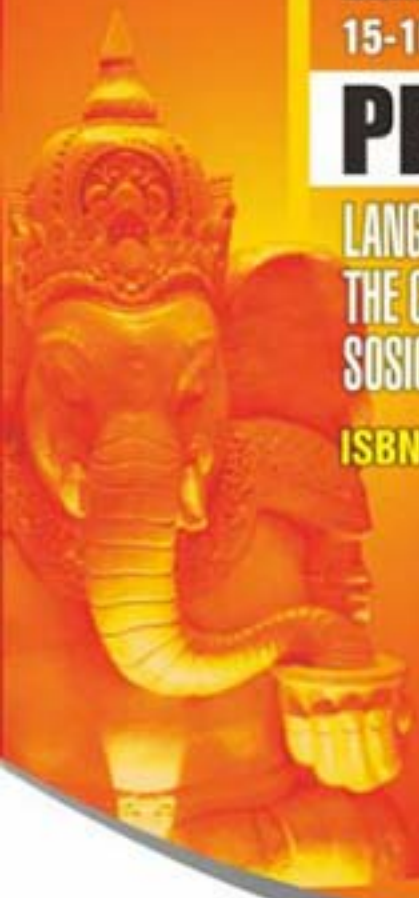

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# Proceeding 8th ADRI 2017 International Conference and Call for Paper, Surabaya, February 15-16, 2017

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# PREFACE

Praise being said to Allah Almighty God for all the grace and guidance that has been given to us all, so the Proceedings of the 8th ADRI 2017 International Conference and Call for Papers Surabaya, February 15-16, 2017 can be realized. Proceedings contains a number of articles and research papers from lecturers, teachers, students, researchers and / or observer of the development of science and technology.

Proceedings are published in book form only contains abstract, distributed to participants in the form of compact disks (full paper) and published online at:
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Hopefully, these proceedings may give benefit to us all, for the development of science, technology, arts, culture, and sports. In addition, is also expected to be a reference for the nation and state-building efforts so that science and technology become a strong pillar in the face of the ASEAN Economic Community.

Lastly, there is no ivory that is not cracked. We are sorry if there are things that are less pleasing.

Thanks you very much.

Surabaya, February 15, 2017.
Publisher Manager of Perkumpulan Ahli & Dosen Republik Indonesia (ADRI),

Andi Mursidi.

## DAFTAR ISI

# ANALYSIS OF COLLEGE STUDENTS ERROR IN SOLVING BASIC MATHEMATICS PROBLEM WITH NEWMAN

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**Abstract.**This study is done with intention to analyze college student error based on NEA (Newman's Error Analysis). NEA is a frame work with diagnostic procedure, they are (1) *decoding*, (2) *comprehension*, (3)*transformation*, (4) *process skill*, and (5) *encoding*.This study take a place at odd semester of 2016/2017. The subject of this study are 6 college student of 2016C class of Mathematics Education that consist of 2 low ability learner, 2 average ability learner, and 2 high ability learner.The instruments of this study are a test sheet consist of 3 basic mathematics problems and an interview guidelines sheet to help discover and back tracking the college student error. The test sheet problems consist of 1 exponent problem, 1 function problem, and 1 permutation problem. The data were analyzed with descriptive qualitative methods. Results of the study shows that 11% of college student shows decoding error, 17% of college student shows comprehension error, 33% of college student shows transformation error, 50% of college student shows process skill error, and 67% of college student shows encoding error. The error often occur in process skill and encoding stage.This errors were caused by the college students low conceptual knowledge, especially low ability learner, so the college students couldn't finish their works.

Keywords**:** Error analysis, basic mathematics, *Newman's Error Analysis*

## I. INTRODUCTION

Mathematics plays an important role in the development of science and technology as well as shaping the human personality [15]. Math could be said as a building whosehave a base, frame work, floor and some elements that attached to it. A building will remain strong when it built on a firm base or foundation. The foundation in learning mathematics for mathematics education college students called mathematical base course. This course serves to strengthen and sustain the mathematics building on student's knowledge.

Mathematical base course is a compulsory course for mathematics education college students. It given to the students at their first semester.So it could said that the entrant of this course are students who hadfreshly graduated from high school. There aresome differences between high school and college students learning style. Students get more guidance and assistance from their teacherswhen learning at the school. But in the college, the students trained to leaning with minimum guidance and assistance from the lecturer. In other words, the college student will be faced with more independent learning style.

Based on the observations of the actual mathematical class,the students in their first semester are still carried out with their old high school learning style. They couldn't accustomed their selves with the new learning environment and style. This problem also occurs with their reference books. High school students usually uses only one reference book in almost all of their subject matter. Butthe college students are required to read more than one reference books for the sake of further student understandings and knowledge development. High school students are still afraid of the teacher, but after being a college student, they are required to be more active in express their opinion and ask what they don't understand to the lecturers.

The course of Mathematical base is an abstract subject matter that containprior knowledge that must be mastered by the college students, even though they are still very simple basic concept of mathematics. The concepts that taught at mathematical base are sets, logics, exponents, functions, permutation, and mathematical induction. This study will analyze the students works at exponents, functions, and permutation matter. Many college students think that this material are the difficult one.

Based on observations in the 2016C class of mathematics education, we know that: a) most of the new college students are still accustomed to learning by memorize without undersanding the concepts inside of a knowledge, b) they are still a pasive member of the class activity so they will stuck by themselves when faced with the concept missconception, and c) they only receive the given materials from the lecturer without effort to search another literatures outside the class to develop and extend their understanding. From these observation result, it can conclude that the new college students difficulty in learning at mathematical base class are because of their low understanding at mathematical concept. This is caused an error in solving basic mathematic problems.

According to Abdurrahman [1], error can be interpreted as anmistake or deviation from what is right, the procedures set forth previously, or deviation from what expected.Luneta and Makonye[13] state that, errors can be differentiate in tho two kind, they are unsystematic errors (such as calculation error) and systematic errors (which is known as misconception). Unsystematic errorsare an unintended mistake which students make and easily corrected by them selves. In other hand, systematic errorsare repeated wrong responses that constructed methodically and produced time by time. Students with systematic errors

There are many tools that can be used to analyse an error such as NEA procedures (Newman's Error Analysis). According to Newman [9], NEA is a framework with a simple diagnostic procedures, which include (1) decoding, (2) comprehension, (3) transformation, (4) process skills, and (5) encoding. Newman developed a diagnostic method that is used to identify and categorize studentserror at mathematical word problem.According to White [14], the inclusion of NEA was a powerful classroom diagnostic assessment and teaching tool for assessing, analysing and catering for student experiencing difficulties with mathematical word problems.NEA experienced a reawakening in Australia and has been included in a number of programs such as the Counting On program in the Australian state of New South Wales.According to Junaidi, et al[5], known that students errors in resolving discrete mathematics caused by: (1) the student did not know the meaning of a symbol or an existing term in the problem (*Reading Errors*), (2) the student did not understandthe meaning of the problem, namely the student fails to write what is known and what is being asked (*Comprehension Errors*), (3) students forgot a formula that will be used or strategy/procedure what to do (*Transformation Errors*), (4) students could not make the problem-solving algorithms in sequence and correctly (*Process Skills Errors*), (5) the student could not answer according to the question (*Encoding Errors*), and (6) the student could not translate well, especially about which was written in English (*Language Errors*).

Newman [9] suggests the following questions used during the interview in order to classify students' mistakes in solving math word problems.

Newman'squestion:

1. Please read the problem. If there is a word you do not know, tell me!
2. Tell me, what is the problem want!
3. Say, how to find the answer!
4. Show me, what was done to obtain the answer. Talk loudly while you work so I can understand what you think.
5. Now, write down your answer.

According to Prakitipong and Nakamura [10], the following conversation describes this method (See Figure 1). In the transcript below, "I" stands for interviewer and "S"stands for student.

(Problem)
A pizza of twelve pieces, costs five hundred twenty eight yen. How much will one piece of pizza cost?
***(Process of Interview)***
I:"Can you read the question?" ***(Reading level)***
S: (Student reads the whole question.)
I: "What does the question ask you to do?" ***(Comprehension level)***
S: "It's asking me to find a piece of pizza, and how much?"
I: "Then, what operation do you work out to find the answer?" ***(Transformation level)***
S: "Using subtraction." ***(Error occurred at this level)***
I: "Can you show me your calculation or write it on this paper?" ***(Process skills)***
S: "There are 12 pieces of pizza, so a piece of pizza is 528–12 = 516."

Fig. 1An Example of Problem and Process of Interview in Newman Procedure

Studentsdifficulties in understanding the material can be traced by looking at the error they made. According Soedjadi, et al [12],studentserrors in answering questions could be seen as an indicator of the difficulties that experienced by the students. Furthermore, according to Soedjadi, et al [12], there are two factors that cause students difficulties, they are intern and extern factors. Intern factors include attitudes, cognitive development, skill and gender. External factors include the teaching method, mathematics materials, and social environments.From the problems explained before, this studyintended to analyse the college students error in solving basic mathematic problems byNewman analysis.

## II. RESEARCH METHOD

This study used descriptive qualitative method. Qualitative research is research that can reveal a phenomenon experienced by the subjects in the form of behavior, perception, motivation, action, etc in a holistic manner and descriptively in the form of words and language, in a specific natural context and using various scientific methods [6].According to Mustafa [8], the major purpose of descriptive survey is to describe the state of affairs as it exists.

This study conducted at the Mathematic education of KanjuruhanUniversity ofMalang. This study take a place at odd semester of 2016/2017. The subject of this study are 6 college student of 2016C class of Mathematics Education that consist of 2 low ability learner, 2 average ability learner, and 2 high ability learner.

The data collected proceduresin this study are: a) test and b) interview. The test problems are made in form of word problem essay to facilitate the tracking back procedure of college students errors. The college students errors are categorize based on NEA's error category, they are : a) reading (decoding), b) comprehension, c) transformation, d) process skills, and e) encoding.

Researchers prepare research instruments, they are : a) test sheet and rubric, and b) structured interview guidelines as a reference to explore data from the subject after they do the test questions. The interviews are used to trackingback through the subject errors while solving the test problem and the factors that made the errors using Newman questions. Before the study take a place, the instrument (test sheet and interview guidelines) will be validated by mathematic education expert beforehand.

Clements [3] used Newman's prompts to analyse 726 grade 5 to 7 pupils' errors in Papua New Guinea and found that 50% of the errors first occurred at the reading, comprehension and transformation levels.Clements [3]

describe the Newman's procedures in diagram shown in Figure 2.

Question form errors are different from those in other categories just like shown in Figure 2 because of the difficulties derived essentially from the question itself is not interaction between learners with the question. Therefore in Figure 2 the question form categories placed next to the five hierarchy. The other two categories, namely careless and motivation, are also shown separately from the hierarchy. This indicated that errors could occur in any level of the hierarchy. For example, a careless mistake could have occurred at reading error, comprehension error, error transformation, and so on. Someone who can read, understand, and capable to transforming the problem into mathematical form may refuse to process further because of a lack of motivation.

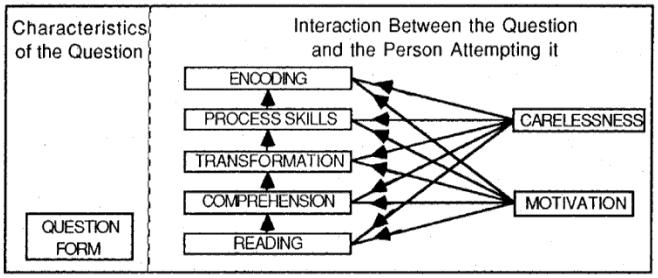


Fig. 2Newmantechnique Diagram

Students Answers analyzed by water model of Miles and Hubermen (2007). The analysis in this study include: a) data reduction, b) data presentation, and c) conclusion. The errors categorize by NEA procedure. Based on the classification of the errors, the conclusion will be made. From the Writings of Singh, Rahman, and Hoon (2010), Jha (2012), Chinama, Nhamburo, and Sithole (2014) it can be concluded that the order of the cause of the error Newman student in solving math problems is as follows :

TABLE 1
THE FACTORS THAT CAUSE AN ERRORS

| Errors | Cause Errors |
|---|---|
| Decoding | the cause of students can not read because, in a sense can not understand the meaning of symbols, terms, or words used in the problem. |
| Comprehension | the cause of students do not understand the meaning of the problem that characterized by students can not write what is known and what is being asked by the problem. |
| Transformation | the cause of students fails to specify what formula is used or failed to find strategies or procedures to be used. |
| Process Skill | the cause of students fails to work or student is not in accordance with the algorithm correctly. |
| Encoding | the cause of students not able to answer according to what is being asked by the problem |

## III. RESULTS AND DISCUSSION

The data of this study consisted of quantitative and qualitative data. The quantitative data that used in this study is student test results score. The results of the average value 2016C exam class students is 71.4. Based on the test results can be traced to what extent the student conceptual understanding of the material foundation of mathematics. Qualitative data used in this study are the result of error tests analysis and interviews with students. From the error analysis, it can be examined the students error source and factors that causing them. So it can be addressed and sought to solve it so that the same error will not be repeated again. In this study there were 6 students working results in 3 problems that analysed. Each of them represent every level of the students ability, they are : low (RP and ATH), medium (LAA and MAM), and high ability (RLP and SK).

TABLE 2
ERROR ON STUDENTS TEST RESULTS

| Problems | Name | Error category | | | | |
|---|---|---|---|---|---|---|
| | | a | b | c | d | e |
| Find the simplest form of this algebraic form: $\left(\frac{4a^2b^3}{6ab^5}\right)^{-1}$ | RP | x | x | x | x | x |
| | ATH | | | | x | x |
| | LAA | | | | | |
| | MAM | | | x | x | x |
| | RLP | | | | | |
| | SK | | | | | |
| Draw the function graphic of the $y = -x^2 + 2x + 3$! | RP | | | x | x | x |
| | ATH | x | x | x | x | x |
| | LAA | | | | | x |
| | MAM | | | | x | x |
| | RLP | | | | | |
| | SK | | | | | x |
| How many letters arrangement can be made from this word "WIYATA"? | RP | | | x | x | x |
| | ATH | | x | x | x | x |
| | LAA | | | | x | x |
| | MAM | | | | | |
| | RLP | | | | | x |
| | SK | | | | | |

***Note:***
***a = decoding***
***b = comprehension***
***c = transformation***
***d = process***
***e = encoding***
***x = there is an error***

Based on table 2, the student errors can be described as Figure 3 below.

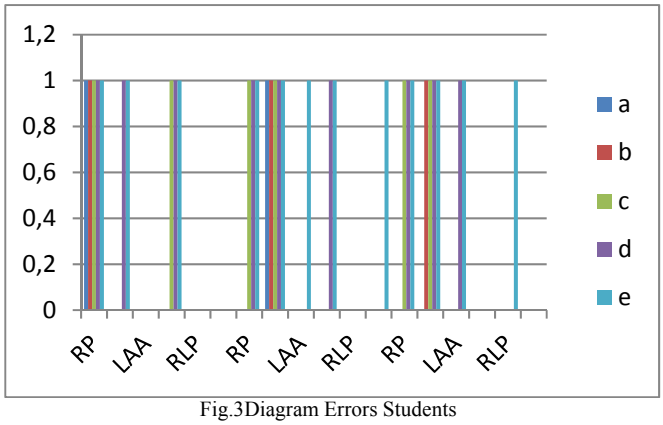


Fig.3Diagram Errors Students

***Note:***
***a = decoding***
***b = comprehension***
***c = transformation***
***d = process***
***e = encoding***
***1 = there is an error***
***0 = no errors***

Based on the analysis of the chosen students errors in test sheets, it can described asfollowing:

1. Decoding Error

Based on NEA's error analysis on second problem, ATH make a decoding errorbecause he don't understand what is known in problem.

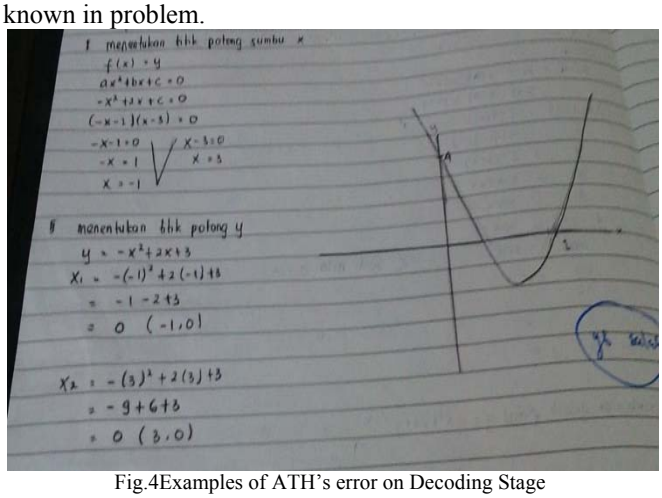


Fig.4Examples of ATH's error on Decoding Stage

2. Comprehension Error

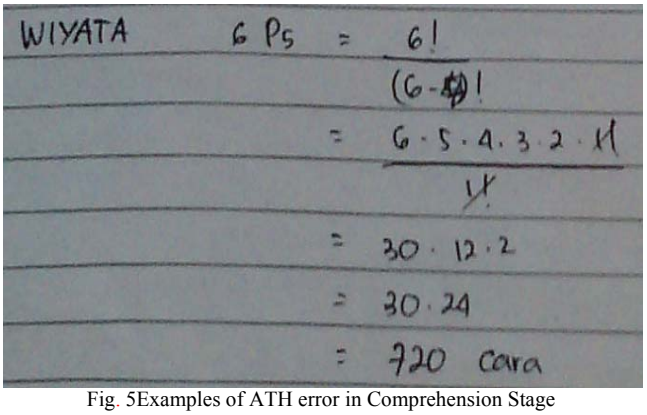


Fig. 5Examples of ATH error in Comprehension Stage

On third question, ATH also make an comprehension error. It because ATH don't understand what is asked in the problem.

3. Transformation Error

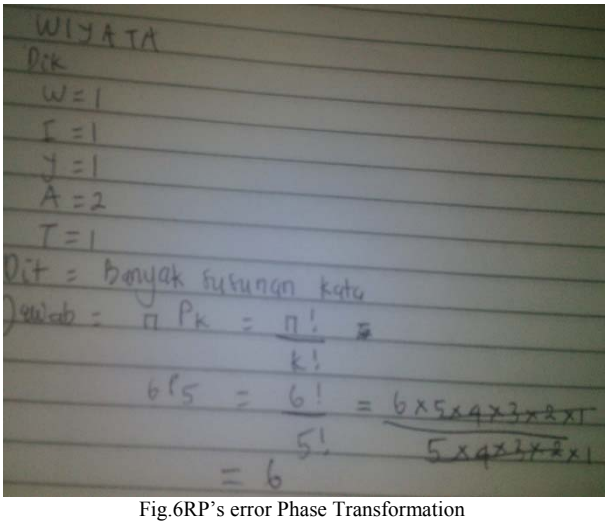


Fig.6RP's error Phase Transformation

Based on NEA's analysis on RP's work at third problem, the transformation error shows because he didn't know the appropriate formula and algorithms to solve the problem. He wrongly wrote $nPk = \frac{n!}{k!}$ as the formula to solve the problem, but the right answershould have $nPk = \frac{n!}{(n-k)!}$.

4. Process Skill Error

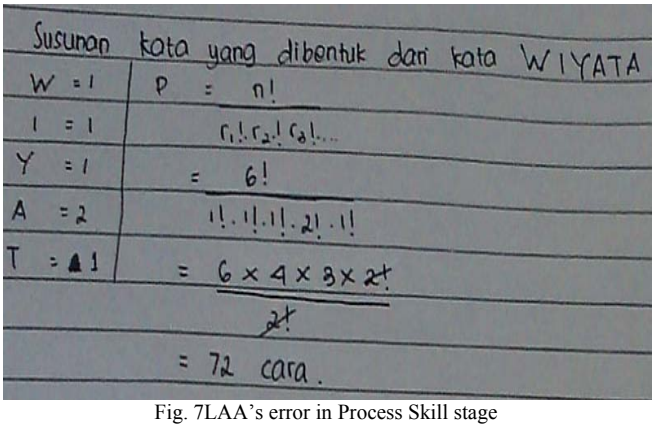


Fig. 7LAA's error in Process Skill stage

Based on NEA procedure, LAA make process skill error on third problem.It because LAA are not careful when outlining 6!.He wrote 6! = 6 x 4 x 3 x 2 but the right way is 6! = 6 x 5 x 4 x 3 x 2 x1. It make his final answer is also wrong.

5. Encoding Error

Based on NEA's procedure, SK make encoding error at first problem.It because he failed to give the final answer. SK wrote $\frac{3ab^5}{2a^2b^3}$as the final answer, but theanswer still could be simplified to$\frac{3b^2}{2a}$.

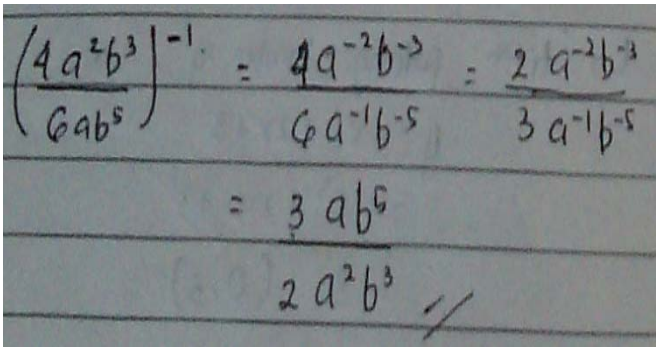

Fig.8SK's errorin Encoding stage

The interviews were conducted after the test ends and the subject work done with the checking step. The results of interviews showed that students who make decoding and comprehension errorbecause they confuse with what to write as the known and ask in the answer sheet. They forget with what they just learn in classroom. Based on the interviews results with the subjects who make transformation error, the subjects got an error because they forgot the appropriate formula to use. They only learn by rote learning and rarely have meaningful learning whichmake them didn't understand the concept given. Based on the interviews results with the subjects who make process skill error, they got an error because they didn't work carefully and lazy to correct the answer. The results of interviews with students who perform encoding errors shows that, they got an error because they don't have enough time to correct the final answer and as the result they failed to give the final answer.

## IV. CONCLUSIONS

From the Newman's error analysis result, it showsthat : a) 11% of college student shows decoding error, b) 17% of college student shows comprehension error, c) 33% of college student shows transformation error, d) 50% of college student shows process skill error, and e ) 67% of college student shows encoding error. Based on the tests and interviews results, can be concluded that the cause of the college students errors in solving basic mathematics problems are: a) the they still didn't understand the concept in that taught at mathematical base course, especially students with low ability, b) they didn't know the appropriate formula and algorithms to apply in solving problems, c) they won't recheck or looking back their own work, and d) they fails to give final answers, make it a lot of them shows process skill and encoding error.

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