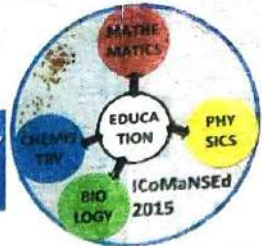




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**Annual Meeting of Mathematics and Natural Sciences Forum of Indonesian Institutes of Teacher Training and Education Personnel (MatricesFor IITTEP)**

In Conjunction With:

**International Conference on Mathematics, Natural Sciences, and Education (ICoMaNSEd 2015)**

August 07-08, 2015, Aryaduta Hotel Manado, Indonesia

# PROCEEDINGS



**Theme:**

“Enhancement and Acceleration on Research and Learning in Mathematics and Natural Sciences for the Utilization of Natural Resources”

**Editors:**

Prof. Dr. Cosmas Poluakan, M.Si.  
Dr. Rymond J. Rumampuk, M.Si.  
Dr. Anetha L. F. Tilaar, M.Si.  
Dr. Heroike D. Rompas, M.Si.  
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## **Proceedings**

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PRESENTER PAPERS

A. MATHEMATICS EDUCATION

THE POTENTIAL AND THE CHALLENGES OF THE DEVELOPMENT AND THE IMPLEMENTATION OF THEMATIC TASK-BASED ASSIGNMENT INSTRUCTION IN MATHEMATICS COMMUNITY IN SANGIHE 47

*Patricia V J Runtu*

THE STUDENTS' MATHEMATICAL LITERACY SKILLS IN SOLVING PISA-TYPE MATHEMATICS PROBLEMS (A STUDY IN MATHEMATICS LITERACY CONTEST IN MANADO, NORTH SULAWESI) 53

*Navel Oktaviandy Mangelep*

EXPLORING ELEMENTARY TEACHERS' BELIEF AND UNDERSTANDING ABOUT MATHEMATICAL PROBLEM SOLVING 59

*Tatag Yuli Eko Siswono, Abdul Haris Rosyidi, Ika Kurniasar<sup>1</sup>, Yuliani Puji Astuti*

THE DESIGN AND EFFECTIVENESS OF MATHEMATICS LEARNING PACKAGES BASED ON BILINGUAL METHOD 67

*Hamzah Upu, Muhammad Basri Djafar, Salam*

THE DESCRIPTION OF MATHEMATICAL COMMUNICATION SKILL OF STUDENTS OF GRADE XI AT MADRASAH ALIYAH NEGERI BATUDAA ON STATISTIC SUBJECT 79

*Arfan Arsyad, Yamin Ismail, Abdul Malik Jusuf*

THE CONTRIBUTION OF THE ABILITY OF CONSTRUCTING MATHEMATICAL MODEL TO SOLVING MATHEMATICAL STORY PROBLEM IN SECONDARY SCHOOL'S STUDENT IN BOLAANG MONGONDOW 91

*Ichdar Domu*

THE COMPARISON OF THE LEARNING RESULT IN TOPIC OF FRACTION IN 7<sup>th</sup> GRADE SECONDARY SCHOOL STUDENTS THAT USE TPS, QUANTUM TEACHING, AND VAK LEARNING MODEL 96

*Ontang Manurung*

B. CHEMISTRY

TERPENOID COMPOUND FROM THE STEM OF MANGROVE PLANT *Avicennia marina* AGAINST HUMAN PATHOGENIC BACTERIA *Staphylococcus aureus* AND *Pseudomonas aeruginosa* 101

*Sintia S. Hingkua, Euis Julaeha, Dikdik Kurnia*

THE MATTEUCINOL FLAVONOID ISOLATED FROM THE STEM OF THE FERN *CHINGIA SAKAYENSIS* (ZEILLER) HOLTZ 106

*Suyatno, Nurul Hidajati, Erika Widiarini, Anandya Wahyuningtyas*

SYNTHESIS OF S-ABS-LS-KAOLIN BLEND AS ELECTROLYTE MEMBRANE FOR FUEL CELLS 110

*Siang Tandi Gonggo, Afadil*

ENZYMATIC PRODUCTION OF VIRGIN COCONUT OIL (VCO) USING THE BROMELAIN IN THE EXTRACT OF PINEAPPLE STEM AND PURIFICATION VCO USING ACTIVE CARBON ADSORBENT 115

*Septiany Ch. Palilingan*

THE EFFECT OF DRYING TEMPERATURE AND DURATION ON THE FATTY ACID PROFILE OF MINCED JERKED BROILER CHICKEN MEAT 121

*Ni Wayan Suriani*

STRUCTURE-ACTIVITY RELATIONSHIP (SAR) OF ENDOCYTOSIS INHIBITORS 130

*Dian H.O. Howan*

SCREENING BIOACTIVE COMPOUND OF STEM BARK SOURSOP (*Annona muricata* LINN) POTENTIAL FOR ANTI-CANCER 138

*Pince Salempa*



## THE CONTRIBUTION OF THE ABILITY OF CONSTRUCTING MATHEMATICAL MODEL TO SOLVING MATHEMATICAL STORY PROBLEM IN SECONDARY SCHOOL'S STUDENT IN BOLAANG MONGONDOW

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### **Abstract**

This study is to measure how high is the level of ability to construct mathematical model and the ability of solving the contextual problems in mathematics of the secondary school's students in Bolaang Mongondow and to measure the contribution of the ability of constructing mathematical model to the ability of solving the mathematical contextual problems.

This descriptive and correlational study was conducted to the students of a public secondary school in Bolaang Mongondow during the first semester of the 2013/2014 academic year. The sample consist of 157 students. The data of the ability of constructing mathematical models and the ability for solving the mathematical problems were obtained by using the instruments test developed by the researcher. The coefficient reliability of the instruments of the ability to construct mathematical model and solving mathematical problems was 0.76 and 0.79 respectively. The technique of analysis was using correlational and regression analysis.

The result revealed that the ability of constructing mathematical model as well as solving mathematical problems of those students is relatively low and both variables are highly related, in this case the level of the ability of solving contextual mathematical problems which highly influenced by the ability of constructing mathematical model is 40.08%. Based on the result, the mathematics teachers in school are expected to increase the ability of constructing mathematical models and solving problems of the student.

**Keywords:** Mathematics, Mathematical Models, The Ability of constructing mathematical model, Story Problems

### **1. Introduction**

Learning mathematics in secondary school is using spiral approach as it's basic. As a consequence, the students are demanded to have an adequate knowledge of basic concept in mathematics. If they do not have such knowledge in mathematics they will find trouble in doing their higher level of learning. Based on teacher's experience, as revealed from the interview made to some of them, they have several problems to present the learning material to the students, for example they have to deal with difficulties in topics involving story problems to solve. The purpose of learning mathematics in school is to give such experience to students so they can solve the mathematical problems, in which they can built up the competence and skill to solve the real world problems (Pimta *et al.* 2009). For this reason, the learning mathematics in school not only focused to the knowledge of theoretical concept but it is expected that all the acquiring knowledge and competence in mathematics will be strengthen student's skill for application to solve the real world problems. Thus, the learning mathematics with involve the story problems is very important to study.

Mayer (1982) explained that the ability of constructing mathematical model is a factor that affects the ability in solving mathematical problems including story problem. He also proposed (Meyer, 1985) that constructing the model is the effort of formulating the parts of



real world problem into mathematical terms. The mathematical model is also involving in the other branch of science, like physics, biology, chemistry, economics, social science etc. In mathematics it is a fast growing study as a part of applied mathematics.

Caldwell and Godin (1987) proposed the basic important concepts in solving problems like the story problems are transformation and computation. The transformation is related to translate and simplify a contextual problem into a mathematical model which is easy to understand. The constructed mathematical model will be very helpful in the computation process to find the solution. The other benefit of modeling according to Kemeney (Kemeney, 1983) is for the scientists, the using of mathematical model is very advantage since mathematical language is an easy way to formulate the hypothesis in a clear and more efficient way.

To translate a problem into mathematical expression is require adequate verbal's comprehension. A verbal ability in math consists of the ability of memorizing and the ability of comprehending the mathematical terms that formulated into the problem. The mistake in reading or understanding a term can lead into wrong procedure of solving the problem. The verbal ability and the numerical literacy are the basic need to formulate mathematical model of a contextual/story problem. To supporting that statement, Santrock (Santrock, 2011) proposed that the procedures should be taking by the students to solve a problem are; 1. Isolate the problem; 2. Develop the strategy for finding the solution; 3. Evaluate all of the proposed solutions; 4. Checking and redefine the problem and the solution continually. These suggestions need the ability in modeling the problem so they can isolate and set the range of the problem, build an effective strategy to find the solution and evaluate them.

There are some steps in constructing mathematical model, as proposed by Meyer (Meyer 1985); Formulation, mathematical manipulation and evaluation. Formulation is how to translate the story problem into mathematical model, mathematical manipulation is the technique of analysis and computation and evaluation is the verification of the result of analysis and computation. Kerr and Maki (1979) also proposed these procedures consist of the identification of the real world problem; using the symbols and mathematical expression and using the tool and mathematical technique (algorithm). Identification related to the understanding of the concept attached within the problem; using the symbol and mathematical expression related to the construction of mathematical model; the use of tools and mathematical technique are relate to analysis and computation to solve the problem.

In term of effectiveness for solving the story problem, Santrock (2011) stated that student should develop the strategy to find the solutions, which are:

1. Defining the sub goal. This is useful for finding sub solutions as part of finding the whole solution. In this case the problem is reduced to some of the easier problems.
2. Algorithm. This is a strategy that provides the guarantee to solve the problem. This comes with the logical procedures to find the possible solutions of the problem. The algorithm consists of formulas, clues and the test of all alternate solutions.
3. Heuristic. This is a strategy that can be seen as the way to solve the problem. Even though it does not really provide a guarantee to solve the problem, this can be helpful for the students to isolate the problem into the right track to find the right solution among all of the possible solutions.

These Santrock's suggested strategies are really depends on the ability of comprehending the problem verbally, numerical and counting skills and constructing the correct mathematical model to find the solution.



Based on the result of previous study of Santrock, it revealed that the factor of the ability of constructing mathematical model is an important variable, theoretically, which affect the ability to find the solution of the mathematical story problem. For this reason, the author is interest to study the contribution of the ability of constructing the mathematical model to the ability of finding the solution of the mathematical story problem. The aims of this study are: 1. How is the level of the ability of secondary school students in solving mathematical story problems. 2. How is the contribution of the ability of constructing mathematical model to the ability of solving mathematical story problems.

## 2. Research Methodology

This quantitative approach with descriptive and correlational method of study was conducted to students of state secondary school in Bolaang Mongondow reGENCY in the academic year of 2013/2014, with the population of the participants of 627 students. The sample size that determined based on the Cohen formula (Cohen, 1977) were 157 students. The independent variable of this study is the ability of constructing the mathematical model and the dependent variable is the ability of solving the mathematical story problem.

The instrument of this study is using 2 packages of test in the form of multiple choices, as the following:

- **Test 1** is to assess the student's ability of constructing the mathematical model. This test is aimed to measure the ability of the student in transform the story problem into symbols or mathematical terms as the effort to simplifying the problem. The mathematical terms and symbols then expressed into an equation or inequality. This test consist of 25 set of problems with coefficient reliability of the test 0.661 .
- **Test 2** is the test of the ability of solving the mathematical story problem. This test is aimed to measure the student ability in solving the mathematical story problem relate to the real world problem. This test consist of 24 set of problems with reliability coefficient of the test 0.790 .

The data analysis of this study is use the descriptive statistics and the hypothesis is tested with correlational analysis with t-test at significance  $\alpha=0.05$  .

## 3. Results and Discussion

The summarize description of the results is presented in the following table (table-1):

**Table 1. Summarize of the results of the descriptive data.**

Variables	Min Score	Max Score	Mean	Median	Modus	SD
X	2	13	6,75	7	9	2,99
Y	1	16	8,63	8	7	3,45

Note:

X = The ability of constructing mathematical model.

Y = The ability of solving the mathematical story problem.

SD= Standard of deviation.

Table-1 revealed the highest score result of the test of the ability of constructing mathematical model is 13 out of 19 and the lowest is 2 out of 19. The mean is 6.75, the median is 7, the modus is 9 and the standard of deviation 2.99. Based on the average score, it showed that the ability of the student is relatively low. Moreover, the table is also revealed the highest score of the ability of solving the mathematical story problem is 16 out of 19 and the lowest score is 1. The mean is 8.63, the median is 8, the modus is 7 and the standard of deviation is 3.45. Based on that score, it revealed that the ability of solving the mathematical story problem is



relatively low. The result of the test of the hypothesis which is “there is a positive correlation between the ability of constructing mathematical model and the ability of solving the mathematical story problem” showed that the coefficient of correlation between those variables is 0.6330 so that the degree of determination is 0.4008. The meaningful test of the coefficient of correlation is using the t-test at sig.  $\alpha = 0.05$ . Based on the t-test, it can be concluded that  $H_0$  is rejected and  $H_1$  is accepted. Thus there is a positive correlation significantly between the ability of constructing mathematical model and the ability of solving the mathematical story problem. The contribution of the variable of the ability of constructing the mathematical model to solve the story problem is 40.08%.

Base on this study, it is known that the ability of constructing mathematical model is influential factor to the ability of solving the mathematical story problem. This finding is support Mayer’s directive, Mayer 1982), which stated that one of the factor that can affect the ability of solving the mathematical problem including the story problem is the ability of constructing mathematical model. In accordance with the result of this study, Caldwell and Goldin (1987) had explained that the basic concepts of solving the story problem are the transformation and the computation. The concept of transformation is related to the translation and simplification of the problem through the construction of mathematical model so that it easy to understand and to support the computation process to find the solution. Thus to strengthen the students’ ability of constructing mathematical model should become one of the teacher’s priority in learning mathematics in secondary school. The mathematical model can be easy to construct if the students have the understanding and the ability to read comprehensively the given problems.

The result of study of Bernardo (Bernardo, 2005) to 111 of 4<sup>th</sup> grade students in Philippines concluded that the factor of the ability to read comprehensively and understand of the story problems are affect the ability of solving the story problems. Thus in learning mathematics in school, the teachers should always focus in strengthen the ability of constructing mathematical model of the students, which can bring the students to be success in their further learning process, especially with topics that contain the mathematical story problems.

#### 4. The Conclusions and Suggestions

As the conclusion of this study are: 1. The average ability of the students of state secondary school in Bolaang Mongondow in solving the mathematical story problems is relatively low, which this can be related to the low ability of constructing mathematical model. 2. The contribution of the variable of the ability of constructing mathematical model to the ability of solving mathematical story problems is 40.08%.

Based on the conclusions, it is suggested to the secondary school’s teachers to have more effort for strengthening the students’ ability in solving mathematical story problems. One of the effort is involving the students in the exercise to solve the problems related to the real world applications (the problems in form of story/contextual). For researchers that have an interest to bring this study in the further are suggested to involve the other assumptions/predictors so it can be more clearly to identify the factors that caused the difficulties to the secondary school students in solving the mathematical story problems.

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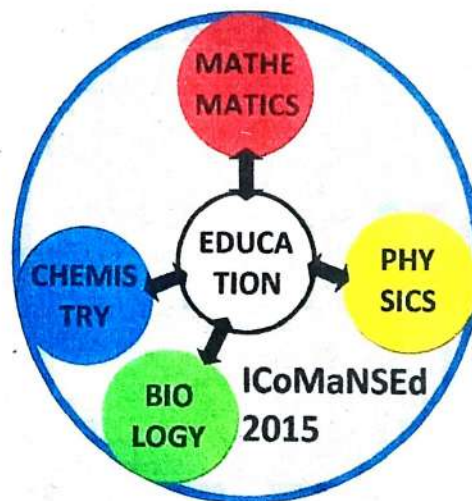


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# Phylosophy of ICoMaNSEd 2015 Logo

Basic form of a large circle symbolizes Mathematics, Science and Education as an integral unit of basic education and basic science, and states the symbol of mathematics geometry. Five small circle-shaped model of molymod express linkage development areas of Mathematics and Science which are centered on education activities. Red for Mathematics states: spirit, gives energy, symbol, action, passion, strength and joy. Yellow for Physics states: warmth and happiness, cheerful symbol and optimistic spirit, stimulate the mind and mental activity. Green for Biology states: calm and relax, the impression of balance the emotions, the symbol of openness and communication, color of hope and the future, justice and peace. Blue for Chemistry states: the calming effect and professional impression and trust. Stimulate communication skills, artistic expression, symbol of strength, able to calm the mind and improve concentration. Generally as a corporate base color, gray for Natural Science Education states: security, reliability, simplicity, and maturity. White for Education states: freedom and openness, represent the purity impression, chaste clean, symbol of peace.



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