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The Sixth Seminar Nasional Pendidikan Matematika Universitas Ahmad Dahlan 2018

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The Preface of the Seminar Nasional Pendidikan Matematika (SENDIKMAD) 2018

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Editor in Chief of SENDIKMAD's 2018 Publication, Universitas Ahmad Dahlan Kampus IV UAD, Jl. Ringroad Selatan, Kragilan, Tamanan, Banguntapan, Bantul, Daerah Istimewa Yogyakarta 55191

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Preface

The Sixth Seminar Nasional Pendidikan Matematika Ahmad Dahlan is a biennial event of Department of Mathematics Education of Universitas Ahmad Dahlan. The objectives are to improve mathematics teaching and to expand mathematics contributions to the society. The main topics of the conference are divided into five categories namely Analysis, Statistics, Algebra, Applied Mathematics, and Mathematics Education.

The keynote presentations are provided especially to show the contribution of Mathematician and Mathematics Educators in the world of mathematics and mathematics education towards research and knowledge sharing where our conference theme for this year is Developing literation skills and High Order Thinking Skills by Innovative Mathematics Learning in Industry Era 4.0. The main event is the talk of the Minister for the Ministry of Education and Culture of the Republic of Indonesia, Professor Dr. Muhadjir Effendy, M.A.P as the first keynote speaker. We have two another keynote speakers coming from Universitas Muhammadiyah Malang, Professor Dr. Yus Mochamad Cholily and Universitas Gadjah Mada, Dr. Nanang Susyanto, M.Sc.

We also have a speaker in workshop session coming from Universitas Ahmad Dahlan, Dr. Rully Charitas Indra Prahmana, S.Si., M.Pd. SENDIKMAD 2018 was an overwhelming success, attracting the delegates, speakers and sponsors from many countries and provided great intellectual and social interaction for the participants. Without their support, the conference would not have been successfully organized. I trust that all the participants found their involvement in the Conference both valuable and rewarding. Our wish is that all participants would enjoy this conference, contribute effectively toward it and take back with you knowledge, experiences, contacts and happy memories of this conference and especially with this beautiful kingdom of Yogyakarta.

Dr. Puguh Wahyu Prasetyo, S.Si., M.Sc

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Keynote Speakers

Muhadjir Effendy	Ministry of Education and Culture of the Republic of Indonesia
Yus Mochamad Cholily	Universitas Muhammadiyah Malang
Nanang Susyanto	Universitas Gadjah Mada

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Figure 1. Muhadjir Effendy, the Minister for Education and Culture delivering his keynote talk on Higher Order Thinking Skills

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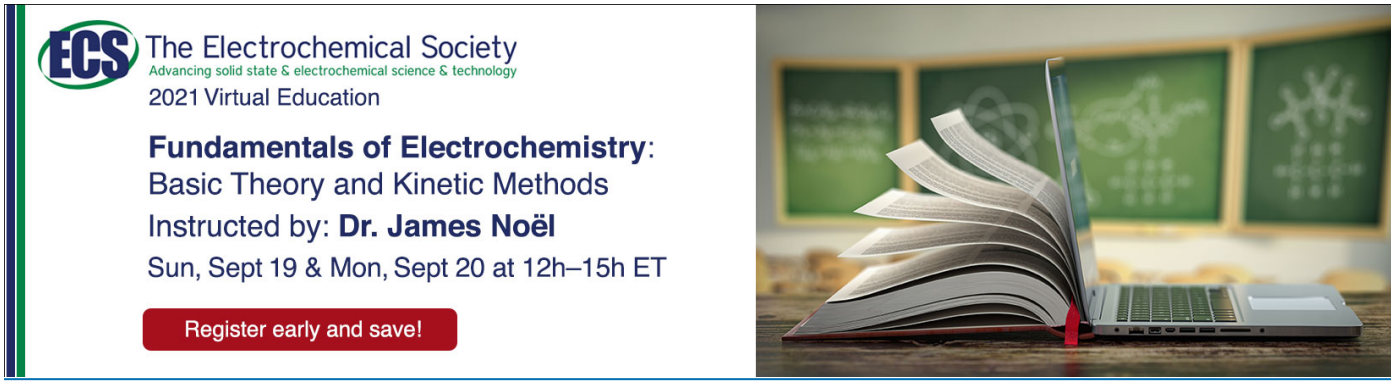

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Improving logical thinking skills using HOTS-based mathematics teaching material

N Anriani[1], A S Pamungkas[1], K Iskandar[1] and A Istiandaru[2]

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Abstract. The purpose of this research is to produce a mathematics material based on high order thinking skills in improving the logical thinking skills of junior high school students. The material in this resource is 'SOLID" for junior high school students of class VIII. This research is research and development. The development model used includes potential problems, information gathering, product design, design validation, design improvements, product trials and product revisions. The test of validity and practicality of the product is assessed by experts, teachers and students. The final product trial was conducted in several schools in Banten province. While the test of product effectiveness is tested using inferential statistical test by looking at the significant difference of pretest and posttest value regarding students' logical thinking skills. The results showed that the product of development results including the category is very valid according to the experts, practically according to the assessment of teachers and students. The resulting product was also effective according to the mean difference test showing that there were significant differences before and after the teaching materials were given at a significance level of 5%.

1. Introduction

The purpose of mathematics learning in secondary education is to prepare students to be able to deal with changing circumstances in life and an ever-expanding world, through practice acting by logical, rational, critical, accurate, honest, efficient and effective thinking [1]. This idea is similar to the opinion that mathematics education has two big goals: giving to the logic of reasoning and personal formation of the child and giving emphasis on the application of mathematics and problem solving [2]. The above is in line with the general goal of NCTM, namely: learning to communicate, reason, solve problems, connect ideas, and mathematics disposition [3]. Abilities are familiar with math skills. Relating to mathematical characteristics can be classified into lower and higher thinking. Activities included in lower-level thinking are performing simple counting operations, applying mathematical formulas directly, following standard procedures. While higher-level thinking activity is to understand the idea of mathematics in depth, observing the data and exploring the implied idea, arranging conjecture, analogy, and generalization, reasoning, non-routine problem solving mathematical communication, and associated mathematical ideas [4].

One of the higher-order thinking activities that are closely related to the characteristics of mathematics is logical thinking; this is because the mathematical matter is understood through reasoning. The importance of logical thinking ability in mathematical learning because there is an association between these aspects and student achievement [5-8]. But the facts in the field found that students' logical thinking ability is still low, according to the facts expressed by Herman that the

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ability of junior high school students is very weak in solving non-routine problems related to the proving, solving problems that require mathematical reasoning, conjecture, and find the relationship between data or facts given [9].

The low logical thinking ability of some junior high school students is caused by the teacher, which in his learning process concentrates too heavily on the exercise of solving more procedural and mechanistic problems rather than concentrating on instilling students' mathematical understanding [10]. In the conventional learning activities, teachers usually start learning by explaining the concept informatively, giving a problem, and end by giving the exercise questions. So with such activity, the learning process is centered on the teacher, the mathematics material is delivered by lecture, passive students, questions from students rarely appear, oriented to one correct answer. With such activities do not provide opportunities for students to develop other math skills. Under such conditions, the government in 2013 made a curriculum change with a scientific approach in the learning process. With the concept of change curriculum, it is expected that math skills, especially those with higher-level thinking, develop well. Application of the 2013 curriculum in the implementation of learning in the classroom is assisted by the availability of teacher books and student books published by the government.

But problems arise when they are found in the handbook, some of which are textbooks that are mechanistic, using more closed questions that press on the final result than the process of getting the answer. With these findings, the creativity of students in thinking during the learning process is not well developed. This phenomenon is due to the ability to criticize an answer and how to answer it becomes unusual because the procedures and rules in solving the problem have been taught in advance by the teacher.

So based on these facts it is developed HOTS-based teaching materials to develop logical thinking ability. Teaching materials are an important tool of learning. Good teaching materials contain learning processes in the classroom more systematically, effectively and efficiently. The Mathematics textbooks not only present the material but lead to a good learning process [11]. According to Suneetha, Rao & Rao and the National Center for Competency-Based Training some of the functions of mathematics teaching materials such as teacher guidance in teaching, reference books and tools for teaching, making learning effective, helping teachers create a worksheet, and stimulating thought and Students' reasoning [11, 12].

The teaching materials developed in this study are teacher manuals and student activities which include RPP and evaluation. The teacher manual contains guides for the learning process and material explanations of student activities. Teacher manual refers to the scientific stage recommended in the curriculum in 2013. Ultimately, the hope of this product development is the availability of alternative teaching materials based on HOTS to develop the logical thinking ability of junior high school students.

2. Method

The type of research conducted is research and development with modification of the development model of Dick & Carey [13]. Stages in this development are gathering information, developing RPP, selecting and developing teaching materials, preliminary trials, revisions, key trials and final product revisions. An initial and main trial conducted in junior high school in Banten Province as many as 11 schools. The quality of teaching materials developed is measured based on the validity, validity, and effectiveness of the teaching materials. The validity of teaching materials is validated by material and media experts. Teachers and students assess the practicality of teaching materials as users of the teaching materials. The effectiveness of teaching materials is assessed based on the achievement of pretest and posttest from students' logical thinking, then compared between logical thinking ability before and after using the teaching materials in classroom learning. Data analysis in this study aims to get a description of the validation, effectiveness and practicability of products developed from the data that has been developed. Test of validity and practicality using descriptive statistics and effectiveness test using paired average difference test.

3. Results and Discussion

3.1 Validity

The validity test aims to provide a theoretical assessment of the instruments and products developed. An experimental test is done by experts, in this research, three experts come from lecturer in mathematics education department of Universitas Sultan Ageng Tirtayasa that is two experts to test product validation and one expert to test instrument validation. Validation of the research instrument is performed by the evaluation expert. Assessment objects assessed were RPP validation sheets, teacher and student manuals and validation papers on logical thinking ability tests. In general, the results of the assessment of the validation sheet and the research instrument are feasible to use and highly valid because suggestions and suggestions from validators have been met.

Product validation is performed by material experts and media experts. Object assessments assessed to refer to the mathematics appraisal instrument issued by the BSNP. In general, the assessment of the products of both validators is worth using with revisions, and the results of validity calculations are highly valid.

3.2 Practicality

Preliminary trials are conducted to see the legibility and practicality of product use. This trial was conducted on mathematics teachers and students in SMPN 7 Kota Serang with 37 students. The teacher and student assessment results generally state that the developed product is practical enough to be used both by teachers and students.

After the initial test, next is the main trial. This trial aims to see the application of products developed on a large scale. The trial was given to 11 junior high school students in Banten province. At the time of execution of the test, the teacher does the learning by the guidance in the RPP that is in the teacher manual and students. Before the premier trial of the teacher provides early and late tests at the end of the use of textbooks.

3.3 Effectiveness

The effectiveness test aims to see if the use of teaching materials developed effectively is used on a large scale or not. This test uses an inferential statistical test that is a test of difference of pairs average. The data processed in this test is pretest and posttest data based on the prerequisite analysis results obtained that the data does not meet the normality test, so the test using the Wilcoxon Test. The research hypothesis proposed in this research is whether there are differences in the ability of logical thinking before and after students given the teaching materials. Here's the statistical hypothesis:

Ho : $\mu_A = \mu_B$

Ha : $\mu_A \neq \mu_B$

Table 1. Wilcoxon test

Null Hypothesis	Test	Sig.	Decision
The median of differences between pretest and posttest equals 0	Related-samples Wilcoxon Signed Rank Test	0.000	Reject the null hypothesis

Asymptotic significances are displayed. The significance level is 0.05.

Based on Table 1, it is found that p-value is less than 0.05, so Ho is rejected, and Ha accepted. This concludes that there are differences in the ability to think logically before and after the use of teaching materials. From these tests show that the use of teaching materials developed effectively used in developing logical thinking ability.

The ability of logical thinking is very important to be developed in students to provide stock to students in the face of the development of the 21st century. Because one of the capabilities demanded in the 21st century is the ability to think logically. Based on the results of the logical thinking ability test obtained the fact that before being given teaching materials the ability is still low at score 23.10

from SMI 100. This score indicates that students do not have good logical thinking ability, meaning that the facts described previously were true. It is based on the results of interviews and observations in schools; students feel strange with the problems that given. Because they have never been given the problem of non-routine problem-solving.

But after given the HOTS-based teaching materials, students' logical thinking ability to develop enough to be equal to score 68.64. This suggests that the use of teaching materials contributes well to the development of students' logical thinking abilities. Students' abilities will increase when students are given the opportunity to explore a given mathematical concept, students in learning activities look active in scientific nuances.

Teaching materials provided to teachers provide guided directions so that the learning process is expected to be achieved. As for the benefits for students, the students' activities are systematic in finding the implicit concepts in the problems posed according to the scientific stage. Thus the use of HOTS-based teaching materials is effectively used in developing students' logical thinking skills, especially on the topic of solid.

4. Conclusion

Based on the validation results by the validators of the products developed in this study can be concluded that the product of this research is HOTS-based textbooks to develop logical thinking ability into the category is very valid. Based on the results of user ratings of teachers and students, overall it can be said that developed products fall into the practical category. Based on the results of the effectiveness test, it can be concluded that learning by using this instructional material proved effective in developing students' logical thinking ability.

Based on the conclusions obtained, then some suggestions for improving the quality of mathematics learning, especially the ability to think logically is the development of material not only on the topic of “solid” but on other topics of various levels.

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