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# Application of Independent Learning to Learn Mathematics Based on Problems HOTS Santri 7th grade MTs Pesantren Al Khairaat Ambon Through PBL

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## Abstract

This study aims to determine the influence of the application of independent learning in HOTS-based mathematics learning on students of 7th grade, MTs Pesantren Al Khairaat Ambon through PBL. This study used a descriptive quantitative approach with a population sample, and all 7th-grade MTs Pesantren Al Kahiraat Ambon students totaled 12 people in 1 study group. Research instruments are: Test questions (pre-test and post-test) are used to measure student learning outcomes before and after learning with PBL, and questionnaires are used to measure student responses after implementing PBL. The test questions completed by students are in the form of HOTS, which contains problems in students' daily lives that are solved by requiring problem-solving analysis. The results showed an influence on the application of independent learning in mathematics based on HOTS on the learning outcomes of 7th grade MTs students of Pesantren Al Khairaat Ambon through PBL. The effect of the application of learning is characterized by a significant difference between the pre-test and the post-test of 7th grade MTs students of Pesantren Al Khairaat Ambon. Based on the Wilcoxon sign rank test obtained a significance value of 0.004 < 0.05, then the null hypothesis (Ho) was rejected, and accepted the alternative hypothesis (Ha). That is, there is a significant difference between the results of learning pre-test and post-test (with the average condition of the post-test value being more than the Pre Test). The aspect of independent learning in this study has not been strictly observed. Therefore further research needs to be given strict attention.

**Keywords:** Independent Learning Mathematics; HOTS Problems; Problem-Based Learning.

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## INTRODUCTION

Education at the unit level, starting from primary to secondary level in Indonesia through the Ministry of Education and Culture, is making breakthroughs through numeracy literacy programs. This is done probably because of the results of the PISA and TIMSS reports of Indonesian students who are ranked low. In 2018 Indonesia's position was in 72 out of 78 countries. This gain is from the previous period's report in 2015 (Istiyono, 2014). As is known that most of the questions used in the evaluation of PISA and TIMSS are applied questions in everyday life, so they require numeracy literacy analysis using higher-order thinking skills.

Numeracy literacy is the knowledge of proficiency to a) use a wide variety of numbers and symbols related to basic mathematics to solve practical problems in everyday life, b) analyze the information displayed in various forms (graphs, tables, charts, and so on) and then use the interpretation of the results of such analysis to predict and make decisions (Budiman & Jailani, 2014) High-order thinking skills (HOTS) questions are questions that awaken the numeracy literation ability of students, whose learning is more emphasized on problem-based learning. Therefore the cognitive/metacognitive domain needs to be leveled based on HOTS (Kusuma, Rosidin, Abdurrahman, & Suyatna, 2017). HOTS is the final three stages or levels of Bloom's thinking skills, analyzing, evaluating, and creating. According to Kings, Goodson, and Rohani, HOTS is the ability to think that requires both the ability to remember and a higher (I Wayan Widana, 2017). According to Kings Goodson and Rohani, HOTS is the ability to think that requires both the ability to remember and a higher ability (Siswoyo & Sunaryo, 2017). Resnick (1987) said that higher-order thinking skills are complex thought processes, the ability to decipher material, make conclusions, build representations, analyze, and build relationships by involving the most basic mental (Ahmad et al., 2018). So the higher level of thinking skills in this study is

a high mental activity in explaining, building representations, analyzing, and building relationships to the material studied, especially in learning mathematics. Furthermore, mathematics learning in this study uses a problem-based learning model (PBL).

According to Peter Ommundsen, problem-based learning is learning that adapts to a learning environment in which the teacher acts as a facilitator between the small groups formed, and the student/students develop their own (Rosidah, 2018). (Hmelo & Ferrari, 1997) The problem-based learning process was designed to cultivate higher-order thinking skills and a flexible knowledge base. Based on these opinions, problem-based learning is a learning process by forming small groups that begin with submitting problems in everyday life designed to cultivate higher-order thinking skills and a flexible knowledge base. Therefore PBL is perfect for helping students become active learners because it puts learning in real-world problems and makes students accountable for their learning. This means that students are independent or independent in learning, including learning mathematics.

Freedom to learn mathematics means that mathematics teachers and schools are more independent in assessing student learning outcomes. Freedom of learning is learning thoroughly, holistically, filling each other, and a learning atmosphere is needed where students have the right to innovate from any side; Learners as individuals and main learning subjects, the teacher directs goals with the child's condition; Teachers use a variety of methods and approaches that suit the learner personally; Freedom of learning does not trouble teachers, students, and parents. Teachers must have the courage to apply independence (Thompson, 2008). According to the minister of education and culture in his circular, Learning from Home through online/distance learning is implemented to provide a meaningful learning experience for students without being burdened with the demands of completing all curriculum achievements for grade increase and graduation.

Furthermore, the study of High Order Thinking Skills has been categorized into three categories, first, the development of HOTS-based instruments (Istiyono, 2014); (Budiman & Jailani, 2014); (Kusuma et al., 2017); (I Wayan Widana, 2017); (Siswoyo & Sunaryo, 2017); (Ahmad et al., 2018). Second, is the development of HOTS-based learning (Rosidah, 2018); (Hamidah, Widjiningsih, Yuriani, & Palupi, 2016). Third, the teacher's interpretation of HOTS by (Thompson, 2008); (Retnawati, Djidu, Kartianom, Apino, & Anazifa, 2018), (Ghazarian & Noorhosseini, 2010); (Yaniawati, 2013); (Marshall & Horton, 2011). Fourth, hots-based thought process (Tanujaya, Mumu, & Margono, 2017). Based on the research above, no one has researched mathematics learning based on High Order Thinking Skills, so this research examines the implementation of HOTS-based mathematics learning in Islamic Boarding Schools.

(Siswoyo & Sunaryo, 2017) said that compiling HOTS-based questions takes a long time and in formulating competency indicators to be measured thinking skills can use Bloom's taxonomy. Furthermore, (Thompson, 2008) said that teachers have difficulty interpreting thinking skills in Bloom's taxonomy and creating test items for higher-level thinking. This study assumes that there is an influence on the application of independent learning in mathematics based on HOTS on the learning outcomes of Class $7^{th}$ grade students of Pesantren Al Khairaat Ambon through PBL.

## METHOD

This research is descriptive quantitative. Because of the existence of variables that will be studied for their relationship and its purpose to present a structured, factual, and accurate picture of the facts and relationships between the variables studied, namely the influence of the application of hots-based independent learning in mathematics on the learning outcomes of $7^{th}$ grade students Al Khairaat Ambon through (Creswell, 2014). In this study, a descriptive

method was used to explain the variables of influence on the application of independent learning in mathematics based on HOTS.

The population in this study was all students of 7th grade MTs Pesantren Al Khairaat Ambon which amounted to 2 classes. Furthermore, the sample in this study was randomly taken from a class from the population, namely 1 class which was considered homogeneous with the number of students as many as 12 people. Research instruments are: Test questions (pre-test and post test) are used to measure student learning outcomes before and after learning with PBL and questionnaires are used to measure student responses after implementing PBL. The test questions completed by students are in the form of HOTS, which contains problems in students' daily lives that are solved by requiring problem-solving analysis. Research data will be collected through 1) Tests. After the test questions are done by the students, they are then checked and given a score. The test data is taken from the results of the student's score. 2) Questionnaire. The questionnaire data is taken from the results of respondents' fills/ticks carried out after learning. All respondents' ticks are then accumulated in their entirety in the form of both positive and negative statements, which are subsequently analyzed. test questions (pre-test and post-test), questionnaires, and learning tools.

Data analysis is carried out with the help of the SPSS program as a tool for regressing the model that has been formulated. The data analysis technique used to analyze the problems in this study is the normality test using a non-parametric test, the Wilcoxon sign rank test. Using a significance level of 5% and carried out using the help of SPSS 15.0 software. Wilcoxon sign rank test formula (Sudiarta & Sadra, 2016). The basis for deciding to accept or reject the hypothesis on the Wilcoxon sign rank test is as follows::

- If the probability (Asymp .Sig) < 0.05 then Ho is rejected meaning there is a difference.
- If the probability (Asymp .Sig) > 0.05 then Ho is accepted meaning there is no difference.

## RESULTS AND DISCUSSION

The mathematics learning process carried out at the Al Khairaat Islamic boarding school in Ambon focuses on students or student centers. When this study was carried out, Indonesia's condition in a critical position of Covid-19 was still in a pandemic period with the Ambon regional at third level. Treatment in the third level area (orange zone) can carry out the learning process in combination, such as Blended learning. This is supported by a circular issued by the Minister of Education and Culture of the Republic of Indonesia research conducted by Alberta Parinters Makur et al. (2021) (Riduwan & Sunarto, 2017). If the learning process is face-to-face, it must be adjusted to health protocols, face-to-face meetings with a maximum of 50% of the number of students, maintaining distance, washing hands, and wearing masks. Even in pandemic conditions, the learning process is still carried out.

Data on the learning outcomes of 7$^{th}$ grade MTs Al Khairaat Ambon students also used pre-test data taken ex post facto from the daily value (daily assessment) of straight-line equation material. The data are taken into consideration that if the pre-requisite material has been studied, then the material of the system of two-variable equations can be easily understood. As for the post-test data, it is taken from HOTS-based tasks that have been completed, both individually and in groups. Data on learning outcomes using SPSS version 15 are presented in the following table.

**Table 1. Descriptive Statistics of Learning Outcomes**

| | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Pre Test | 12 | 79 | 95 | 88.83 | 5.781 |
| Post Test | 12 | 90 | 95 | 92.17 | 2.12 |
| Valid N (listwise) | 12 | | | | |

Based on the SPSS version 15 data mentioned above, it can be seen that the learning outcomes of 7$^{th}$ grade MTs Al Khairaat Ambon students are in the very

high category. Furthermore, the difference in value gains between pre-test and post-test, is illustrated in the following table.

**Table 2. Ranks**

| | | N | Mean Rank | Sum of Ranks |
|---|---|---|---|---|
| **Post Test - Pre Test** | **Negative Ranks** | 0(a) | 0.00 | 0.00 |
| | **Positive Ranks** | 10(b) | 5.50 | 55.0 |
| | **Ties** | 2(c) | | |
| | **Total** | 12 | | |

a Post Test < Pre Test

b Post Test > Pre Test

c Post Test = Pre Test

Based on Table 2 above, no student has obtained a post test score less than his pre-test score. A total of 10 students who obtained a post-test score of more than the pre-test score. Furthermore, there were as many as 2 students who obtained the same score between the post test and the pre-test. Furthermore, the following table illustrates the score of the acquisition of the interest questionnaire and its categories.

**Table 3. Tabulation of The Interest Questionnaire Score of Class 7th grade MTs Al Khairat Students in Java City Towards PBL**

| No. | Interval | Category | Frequency | Percentage |
|---|---|---|---|---|
| 1 | 0-24 | Not Interested | 0 | 0% |
| 2 | 25-49 | Less Interested | 0 | 0% |
| 3 | 50-74 | Interested | 0 | 0% |
| 4 | 75-100 | Very Interested | 12 | 100% |
| **Sum** | | | 12 | 100% |

Based on Table 3 above, the response of 7th grade al Khairaat Ambon students was in the category of being very interested in the application of HOTS-based PBL, even 12 students out of 12. This means that as many as 100% of students are very interested in this learning process. This is supported by the results of research conducted by (Maria & Hasruddin, 2019).

The mathematics learning process at MTs Al Khairaat Ambon uses mathematical problems as a basis for learning, it can be seen from students always responding to problems posed by researchers. This is in line with the usefulness of problems in problem-based learning presented by Wood (2003) that PBL is not about the percentage of problem-solving, but rather uses the right problem to improve knowledge and understanding (Makur et al., 2021). Uniquely, all MTs Al Khairaat students are trained to learn independently by solving all the problems in the package book used in the madrasah without being asked by the math teacher. So that learning will begin with problems or difficulties for students in solving problems. This is in line with what was conveyed by Nurfadilah and Hakim in their research (Nurfadilah & Hakim, 2019)

Based on the data of the questionnaire of interest in following the learning process through questionnaires filled in by students and learning outcomes obtained through the completion of the assigned tasks, as well as comparing the results of post-test learning to the pre-test using the wilcoxon sign rank test, it illustrates that the influence of the application of independent learning of HOTS-based mathematics learning on the learning outcomes of students of 7$^{th}$ grade MTs Pesantren Al Khairaat Ambon has an effect. As shown in Table below.

**Table 4. Test Statistics(b)**

| | **Post Test - Pre Test** |
|---|---|
| **Z** | -2.869(a) |
| **Asymp. Sig. (2-tailed)** | .004 |

a Based on negative ranks.

b Wilcoxon Signed Ranks Test

Furthermore, Based on table 1.1 above from the results of its significance it is seen that 0.004 < 0.05 then the null hypothesis (Ho) is rejected and accepts the alternative hypothesis (H-a). This means that there is a significant difference

between the results of the pre-test and the post-test which means that there is a significant influence between the application of independent learning of HOTS-based mathematics learning on the learning outcomes of students of 7th grade MTs Pesantren Al Khairaat Ambon. This is supported by research conducted by (Lestari Bandi, Hasnawati, & Ikman, 2015) that Learning using a problem-based learning model approach has a significant positive influence on student mathematics learning outcomes.

Based on the results of the study, the learning outcomes of students between the pre-test and the post-test experienced differences but based on the Wilcoxon sign rank test, it illustrates that there is a significant influence between the pre-test results and the post-test, the learning outcomes of the MTs students of Pesantren Al Khairaat Ambon have increased between the pre-test and the post-test. This is possible because the pre-test value taken is the daily assessment value (PH) of the previous subject matter (straight line equation). The learning outcomes obtained by the students of 7th grade MTs Pesantren Al Khairaat Ambon are in the very high category. This is as stated by Ridwan and H Sunarto about categorizing learning outcomes using benchmark reference assessment (PAP) (Riduwan & Sunarto, 2017). Based on these very high categories, it means that the implementation of PBL based on HOTS is responded to well by the students.

The application of independent learning of mathematics based on HOTS affects the learning outcomes of students of 7th grade MTs Pesantren Al Khairaat Ambon through PBL. This is evidenced by the wilcoxon sign rank test, describing that there is a significant influence between the pre-test results and the post test, which is 0.004 < 0.005 which means that there is a significant difference between the pre-test and post-test results. Thus, based on the results of significance, it can be seen that the learning outcomes of 7th grade MTs students of Pesantren Al Khairat Ambon are influenced by independent learning of HOTS-based mathematics through PBL.

## CONCLUSION

Based on the results of the research and discussion, it was concluded that there was a significant influence on the application of independent learning in mathematics based on HOTS on the learning outcomes of class 7th grade students of MTs Al Khairat Ambon through PBL. It is proven through the Wilcoxon sign rank test between the pre-test results and the post-test, namely class 7th grade MTs Al Khairat students, with a significance of 0.004 < 0.05.

## REFERENCE

Ahmad, S., Prahmana, R. C. I., Kenedi, A. K., Helsa, Y., Arianil, Y., & Zainil, M. (2018). The instruments of higher order thinking skills. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/943/1/012053

Budiman, A., & Jailani. (2014). Pengembangan Instrumen Asesmen Higher Order Thinking Skill (HOTS) ... ( Agus Budiman, Jailani ) - 139. *Riset Pendidikan Matematika*.

Creswell, J. W. (2014). Research Design : Pendekatan Kualitatif, Kuantitatif, dan Mixed. In *Research design: qualitative, quantitative and mixed methods approaches*. https://doi.org/45593:01

Ghazarian, A., & Noorhosseini, S. M. (2010). Automatic detection of users' skill levels using high-frequency user interface events. *User Modeling and User-Adapted Interaction*. https://doi.org/10.1007/s11257-010-9073-5

Hamidah, S., Widjiningsih, -, Yuriani, -, & Palupi, S. (2016). *Integrated Problem Based Learning for Improvement Soft Skill and High Order Thingking of Vocational Students*. https://doi.org/10.2991/icieve-15.2016.41

Hmelo, C. E., & Ferrari, M. (1997). The problem-based learning tutorial: Cultivating higher order thinking skills. *Journal for the Education of the Gifted*, *20*(4), 401–422. https://doi.org/10.1177/016235329702000405

I Wayan Widana. (2017). Modul Penyusunan Higher Order Thingking Skill (HOTS). In *Direktorat Pembinaan Sma Direktorat Jenderal Pendidikan Dasar Dan Menengah Departemen Pendidikan Dan Kebudayaan 2017*.

Istiyono, E. (2014). DEVELOPING HIGHER ORDER THINKING SKILL TEST OF PHYSICS (PhysTHOTS) FOR SENIOR HIGH SCHOOL STUDENTS. *Penelitian Dan Evaluasi Pendidikan*.

Kesumawati, N. (2008). Pemahaman Konsep Matematik dalam Pembelajaran Matematika. *Pendidikan Matematika*, *2*(2), 229–235. https://doi.org/10.13140/RG.2.2.13994.00965

Kusuma, M. D., Rosidin, U., Abdurrahman, A., & Suyatna, A. (2017). The Development of Higher Order Thinking Skill (Hots) Instrument Assessment In Physics Study. *IOSR Journal of Research & Method in Education (IOSRJRME)*. https://doi.org/10.9790/7388-0701052632

Lestari Bandi, N. T. L., Hasnawati, & Ikman. (2015). Pengaruh Model Pembelajaran Berbasis Masalah Terhadap Hasil Belajar Matematika Siswa Kelas VIII SMP Negeri 12 Kendari. *Jurnal Penelitian Pendidikan Matematika*, *3*(3), 69–82.

Makur, A. P., Jehadus, E., Fedi, S., Jelatu, S., Murni, V., & Raga, P. (2021). Kemandirian Belajar Mahasiswa dalam Pembelajaran Jarak Jauh Selama Masa Pandemi. *Mosharafa: Jurnal Pendidikan Matematika*, *10*(1), 1.

Maria, B., & Hasruddin, A. Y. (2019). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Hasil Belajar Dan Kemampuan Berpikir Kritis Siswa. *Jurnal Tematik*, *9*(3), 191–200.

Marshall, J. C., & Horton, R. M. (2011). The Relationship of Teacher-Facilitated, Inquiry-Based Instruction to Student Higher-Order Thinking. *School Science and Mathematics*. https://doi.org/10.1111/j.1949-8594.2010.00066.x

Nurfadilah, S., & Hakim, D. L. (2019). Kemandirian Belajar Siswa dalam Pembelajaran Matematika. *Prosiding Sesiomadika 2019*, 1214–1223.

Retnawati, H., Djidu, H., Kartianom, Apino, E., & Anazifa, R. D. (2018). Teachers' knowledge about higher-order thinking skills and its learning strategy. *Problems of Education in the 21st Century*.

Riduwan, & Sunarto. (2017). Pengantar Statistika untuk Penelitian: Pendidikan,

Sosial, Komunikasi, Ekonomi dan Bisnis. In *Alfabeta, Bandung*.

Rosidah, C. T. (2018). PENERAPAN MODEL PROBLEM BASED LEARNING UNTUK MENUMBUHKEMBANGKAN HIGHER ORDER THINKING SKILL SISWA SEKOLAH DASAR. *INVENTA*. https://doi.org/10.36456/inventa.2.1.a1627

Siswoyo, S., & Sunaryo, S. (2017). High Order Thinking Skills: Analisis Soal dan Implementasinya dalam Pembelajaran Fisika di Sekolah Menengah Atas. *Jurnal Penelitian & Pengembangan Pendidikan Fisika*. https://doi.org/10.21009/1.03102

Sudiarta, I. G. P., & Sadra, I. W. (2016). PENGARUH MODEL BLENDED LEARNING BERBANTUAN VIDEO ANIMASI TERHADAP KEMAMPUAN PEMECAHAN MASALAH DAN PEMAHAMAN KONSEP SISWA. *Jurnal Pendidikan Dan Pengajaran*, *49*(2), 48. https://doi.org/10.23887/jppundiksha.v49i2.9009

Tanujaya, B., Mumu, J., & Margono, G. (2017). The Relationship between Higher Order Thinking Skills and Academic Performance of Student in Mathematics Instruction. *International Education Studies*. https://doi.org/10.5539/ies.v10n11p78

Thompson, T. (2008). Mathematics teachers' interpretation of higher-order thinking in Bloom's taxonomy. *International Electronic Journal of Mathematics Education*.

Yaniawati, R. P. (2013). E-Learning to Improve Higher Order Thinking Skills (HOTS) of Students. *Journal of Education and Learning (EduLearn)*. https://doi.org/10.11591/edulearn.v7i2.225