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The Effectiveness of the Means-Ends Analysis Learning Model with a Realistic Approach toward Mathematical Creative Thinking Ability in terms of Self -Regulated Learning

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Abstract: This research is a quantitative research, the purpose of this research is to determine the effectiveness of the MEA learning model with a realistic approach to students' mathematical creative thinking abilities in terms of self-regulated learning. This type of research is True Experimental with Pretest Posttest Control Group Design. Data collection techniques used in this study were tests of mathematical creative thinking skills, self-learning questionnaires, and documentation. From this study it can be concluded that the learning model means ends analysis with a realistic approach is effective for mathematical creative thinking abilities.

Keywords: mathematical creative thinking ability, Means-Ends Analysis, realistic approach, self -regulated learning

Abstrak: *Penelitian ini merupakan penelitian kuantitatif, tujuan penelitiann ini untuk mengetahui efektifitas dari model pembelajaran Means-Ends Analysis (MEA) dengan pendekatan realistik terhadap kemampuan berpikir kreatif matematis siswa ditinjau dari kemandirian belajar. Jenis penelitian ini adalah True Experimental dengan Pretest Posttest Control Grup Design. Teknik pengumpulan data yang digunakan pada penelitian ini adalah tes kemampuan berpikir kreatif matematis, angket kemandirian belajar, dan dokumentasi. Dari penelitian ini dapat disimpulkan bahwa model pembelajaran means ends analysis dengan pendekatan realistik efektif terhadap kemampuan berpikir kreatif matematis.*

Kata kunci: *kemampuan berpikir kreatif matematis, Means-Ends Analysis, pendekatan realistik, kemandirian belajar siswa*

▪ INTRODUCTION

Mathematics is one of the subjects taught in schools in the education curriculum in Indonesia. Mathematics is one of the main subjects that has existed since elementary education which can form patterns or ways of thinking systematically, creatively, logically and critically. However, in practice students still find it difficult to build systematic, creative, logical and critical patterns of thinking to solve a mathematical problem. Students only depend on the teacher's explanation so that they cannot form their thinking patterns properly. In line with the opinion of Sidik, Desmayanasari & Noprisa (2020) which states that the teacher in the teaching and learning process in the classroom is not only a transferor of knowledge in teaching mathematics. However, it must be able to develop the mindset of students in learning. The mindset referred to here is students to be able to think creatively through mathematics lessons. Students' mathematical creative thinking ability is still low in the application of learning that takes place in class. Students have not been able to solve problems in a non-routine way. Students only depend on the teacher's way of explaining the material so that this causes students to be less creative in solving mathematical problems.

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According to the OECD (Aripin & Purwasih, 2017) the ability to think creatively in mathematics is still low. Based on TIMSS 2015, Indonesia's Mathematics achievement was ranked 44 out of 49 countries with a score of 397 points (IEA's Trends International Mathematics And Science Study, 2015). At TIMSS 2015, Indonesia is also weak in the cognitive aspect of reasoning ability, which is 20% (Pribadi, Somakin, Yusup, 2017). According to Nasution (2017) students still do not have the ability to solve non-routine problems related to proving, generalizing, making assumptions, reasoning, and finding relationships between given facts or questions needed for higher order thinking. According to Nanang (2016) states that on the other hand, student learning independence must be developed in the learning process. Because students who study independently will try their best to get satisfaction in learning. Because in the process of creative thinking, independent learning is needed so that students do not only depend on the teacher, but they can also practice their creative thinking skills by studying independently without relying on the teacher's explanation.

It is necessary to have a learning model that seeks to explore students' skills in mathematical creative thinking to foster students' creative thinking abilities. One learning model that is considered suitable is learning that uses the Means-Ends Analysis model. According to (Ariyanti, Isnaniah & Jasmienti, 2019) the learning model means-ends analysis is learning to separate known problems from the goals to be achieved and then determine the differences and choose methods to minimize these differences. According to Juanda, Johar and Ikhsan (2014) the stages learning of MEA are: 1) Identifying the differences between the current state and the goal state (current stage); 2) Arrange sub goals (subgoals) so that connectivity occurs; 3) Choose the right Operator and apply it so that the sub-goals that have been prepared can be achieved.

Efforts to support the ongoing learning of the MEA model require a learning approach that helps students to analyze real problems. Through this approach, students are expected to be able to cultivate mathematical creative thinking skills related to real problems that exist in students' daily lives. One way that can be used to analyze problems with real cases in students' daily lives is to use a realistic approach. PMRI is a useful approach to improve the quality of education in Indonesia whose idea comes from Realistic Mathematics Education (Zulkardi, 2002). PMRI is focused on students so that they can form their own knowledge through the importance of activities in classroom learning (Idris & Silalahi, 2016).

▪ METHOD

Participants

The population in this study were all class VII students of SMP Negeri 39 Semarang for the 2021/2022 academic year. In this study, the sampling used cluster random sampling technique. The sample of this study was class VII A as the experimental class using the Means-Ends Analysis (MEA) learning model with a realistic approach and class VII B as the control class using the Problem Based Learning (PBL) learning model.

Research Design and Procedures

This research is a quantitative research. This type of research is True Experimental with Pretest Posttest Control Group Design (Sugiyono, 2015). The

following table presents Pretest Posttest Control Group Design.

Table 1. Pretest posttest control group design

Group	*Pretest*	Treatment	*Posttest*
E	O1	X1	O2
K	O1	X2	O2

Information
E: Experimental group; K: Control group; O1: Pretest; O2 : Post test; X1: MEA learning with a realistic approach; X2: PBL Learning

This research was conducted in four meetings, at the first meeting a pretest was carried out and for the last meeting a posttest was carried out.

Instruments

Data collection techniques used in this study were tests of mathematical creative thinking skills and questionnaires and documentation.

The mathematical creative thinking test was carried out twice, namely the initial ability test (pretest) and the final ability test (posttest) as a measuring tool to test the effectiveness of MEA learning with a realistic approach to students' mathematical creative thinking abilities. The questions used in the pretest and posttest are five questions. Where each question contains one indicator of creative thinking. The indicators of the ability to think creatively are as follows:

Table 2. Indicators of mathematical creative thinking ability

Indicator of Creative Thinking Ability	About KBKM	Description of Indicators of Creative Thinking Ability
Fluency	Question number 1	1. Able to interpret the problem (question) in a known and asked form. 2. Ability to come up with lots of ideas/ideas in solving problems accurately and smoothly.
Flexibility	Question number 2	1. Able to apply the formula correctly. 2. Ability to generate ideas, varied answers.
Originality	Question number 3	1. Able to write answers in their own way. 2. The ability to generate ideas/unique or unusual ways of solving mathematical problems.
Elaboration	Question number 4	1. The ability to expand an idea to solve mathematical problems in detail. 2. Able to conclude the answers that have been presented.

Self-regulated learning questionnaire to determine the value of student's self-regulated learning. This study uses indicators of self-regulated learning as according to Damayanti, Sumarmo, and Maya (2018), which are as follows: a) Have own learning

initiatives, b) Diagnose learning needs, c) Choose learning goals/targets, d) organize and control their own learning, e) viewing difficulties as challenges, f) utilizing and searching for relevant learning resources, g) selecting and implementing learning strategies, h) evaluating learning processes and outcomes, i) self-concept.

Data analysis

The data analysis used was the initial data analysis using normality, homogeneity, and initial average similarity tests, for final data analysis using individual completeness tests, classical completeness tests, average difference tests, and simple linear regression.

▪ RESULT AND DISSCUSSION

For the purposes of testing the hypothesis using individual completeness tests, classical completeness tests, average difference tests and simple linear regression. After the data is obtained, it must be tested for normality, homogeneity of variance, and initial average similarity test before proceeding to hypothesis testing.The normality test is used to determine whether the sample comes from a normally distributed population or not. Based on the calculation results One-Sample Kolmogorov-Smirnov test shows that the normality of the initial data Sig. = 0.116 <0.05 and the normality of the final data Sig. = 0.116 > 0.05, then H0 is accepted, which means that the sample comes from a normally distributed population. The homogeneity of variance test is intended to determine whether the two classes sampled have the same variance or not. Based on the calculation results Test of Homogeneity of Variancesshows initial homogeneity Sig.= 0.372 > 0.05 and final homogeneity Sig.= 0.58 > 0.05 then H0 is accepted which means that the variances of the two classes are homogeneous. Based on calculations t-test for Equality of Meansthe value of Sig. = 0.753 > 0.05 then H0 is accepted which means that the initial average of mathematical creative thinking skills in the two classes is not significantly different. Based on the prerequisite tests, namely the normality test, homogeneity of variance, and the initial average similarity test, it can be concluded that the data from all groups come from populations that are normally distributed, have a homogeneous variance and the same initial mean. Therefore, hypothesis testing can be done.

Based on the One-Sample test statistic test, p value = 0.000 < 0.05 which indicates that the average test results for students' mathematical creative thinking abilities in MEA learning with a realistic approach are more than 70. This indicates that the students' mathematical creative thinking ability scores are more than 70 or more from the specified KKM, so students mathematical creative thinking skills in MEA learning with a realistic approach to achieving individual mastery. Based on the classical completeness test, the calculation process obtained $zhitung > z(0{,}45)$ with a value of 0.5025 > 0.1736 which means that the proportion of students who complete individually in MEA learning with a realistic approach is more than 75%. Based on the results of this study, it shows that the value of students' mathematical creative thinking abilities who have completed KKM is more than 75%, so that students' mathematical creative thinking abilities in MEA learning with a realistic approach achieve classical mastery. This is in line with the research of Octaviana and Kurniasih (2020) which states that the results of the average test analysis in MEA learning on aspects of students' mathematical creative thinking abilities exceed KKM 73 and are more than or equal to

75% of the number obtained by students. In line with the research of Permatasari, Veronica, & Susilo (2013) which stated that the learning outcomes of students who received the Problem Posing learning model with the PMRI approach achieved individual and classical mastery. so that students' mathematical creative thinking abilities in MEA learning with a realistic approach achieve classical mastery.

Based on testt-test for Equality of Meanshas a value of 2 × Sig. (2-tailed) = 2 × 0.004 = 0.016 < 0.05, which meansthat the average creative thinking ability of students in MEA learning with a realistic approach is more than the average creative thinking ability of students in PBL learning. Based on the results of this study shows thatthe average mathematical creative thinking ability of students in MEA learning with a realistic approach is better than the average mathematical creative thinking ability of students in Problem Based Learning (PBL) learning. In line with the research of Solikah & Himmah (2019) which states that there is a difference in the average posttest score between the experimental class and the control class, this shows that the average posttest score of the experimental class is higher than the average posttest score of the control class. This is also in line with the research of Susanti, Susanta & Muchlis (2019) which states that the learning outcomes of students who use the MEA learning model are better than the learning outcomes of students who use expository learning. In line with the research of Permatasari, Veronica, &

Based on the simple linear regression statistical test ANOVA, the value of p value = 0.000 < 0.05, which means that there is an influence of self-regulated learning on students' mathematical creative thinking abilities. Based on the simple linear regression statistical test, the magnitude of the influence of self-regulated learning on mathematical creative thinking ability obtained an R square value of 0,333. This means that self regulated learning has an effect on mathematical creative thinking ability of 33,3%, while the remaining 66,3% is influenced by other variables. In line with research by Erni, Ma'rufi & Ilyas (2022) which states that self-regulated learning has a significant effect on students' mathematical creative thinking abilities. This influence has an important impact on increasing student's self –regulated learning and stimulating them to carry out learning activities to think creatively in solving mathematical problems. In line with the opinion of Hikmasari, Kartono, & Asih (2020) which states that one of the important factors of individual circumstances that affects learning is learning independence.

The results showed that the ability to think creatively mathematically with the MEA learning model with a realistic approach was completed individually and classically, the average mathematical creative thinking ability in the MEA learning model with a realistic approach was better than the ability to think creatively mathematically in the PBL learning model. Learning Means Ends Analysis (MEA) with an effective realistic approach to students' mathematical creative thinking abilities. This is in line with Octaviana & Kurniasih's research (2020) which states that learning Means Ends Analysis (MEA) is effective for mathematical creative thinking skills. Research conducted by Durachman & Cahyo (2020) also states that learning with a realistic mathematical approach is effective for the ability to think creatively mathematically. In line with research by Permatasari, Veronica, & Susilo (2013) which states that the Problem Posing learning model with the PMRI approach is effective for students' creative thinking abilities. In addition to the effectiveness of the Means Ends Analysis

(MEA) learning model, the self-regulated learning factor also influences students' mathematical creative thinking ability, which is equal to 33.3%.

▪ CONCLUSION

Based on the results of the study, information was obtained that (1) students' mathematical creative thinking abilities in MEA learning with a realistic approach achieved individual mastery; (2) students' mathematical creative thinking skills in MEA learning with a realistic approach to achieve classical mastery; (3) the average mathematical creative thinking ability of students in MEA learning with a realistic approach is better than the average mathematical creative thinking ability of students in Problem Based Learning (PBL) learning; and (4) there is an influence of self-regulated learning on students' mathematical creative thinking abilities in MEA learning with a realistic approach. It can be concluded that learning using the Means Ends Analysis (MEA) learning model with a realistic approach for class VII students of SMP Negeri 39 Semarang is said to be effective in increasing students' mathematical creative thinking abilities and self-regulated learning also has an effect of 33,3% on students' mathematical creative thinking abilities.

The suggestion put forward is that the results of this research are expected to be used as material for consideration and input for schools and teachers to use the Means Ends Analysis (MEA) learning model to improve students' mathematical creative thinking skills, especially in rectangular shape material.

▪ REFERENCES

Aripin, U. & Purwasih, R. (2017). *Penerapan pembelajaran berbasis alternative solutions worksheet untuk meningkatkan kemampuan berpikir kreatif matematik.* [application of alternative solutions worksheet-based learning to improve mathematical creative thinking ability]. *Journal of Mathematics Education FKIP Univ. Muhammadiyah Metro, 6(2),* 225-233.

Ariyanti, D., Isnaniah, & Jasmienti. (2019). *Pengaruh penerapan model pembelajaran means-ends analysis terhadap kemampuan berpikir kritis matematika siswa kelas viii smp n 1 rao* [the effect of applying the means-ends analysis learning model on the mathematical critical thinking ability of class viii students of smp n 1 rao]. *Juring : Journal for Research in Mathematics Learning, 2(1),* 111-117.

Durachman & Cahyo, ED (2020). *Pengaruh pendekatan matematika realistik terhadap kemampuan berpikir kreatif dan koneksi matematis siswa*. [the effect of a realistic mathematical approach on students' creative thinking ability and mathematical connections]. *Tapis: Jurnal Penelitian Ilmiah, 4(1),* 56-74.

Erni, Ma'rufi & Ilyas, M. (2022). *Pegaruh kemandirian belajar terhadap kemampuan berpikir kreatif matematis siswa* [the effect of learning independence on students' mathematical creative thinking ability]. *Jurnal Riset HOTS Pendidikan Matematika* [HOTS Research Journal of Mathematics Education], 2(1), 53 -61.

Hikmasari, P., Kartono, K., & Asih, TSN (2020). *Pengaruh audience feedback pada pencapaian kemampuan pemecahan masalah matematika dan kemandirian belajar dengan model discovery learning* [the effect of audience feedback on the achievement of mathematical problem solving ability and independent learning

with the discovery learning model]. *In PRISMA: Prosiding Seminar Nasional Matematika* [Proceedings of the National Mathematics Seminar], 3, 514-517.

Idris, I., & Silalahi, D. (2016). *Penerapan pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) untuk meningkatkan kemampuan penyelesaian soal cerita pada kelas VII A SMP UTY* [Application of the Indonesian Realistic Mathematics Education (PMRI) approach to improve the ability to solve word problems in class VII A SMP UTY]. EduMatSains Journal, 1(1), 73-82.

IEA's Trends International Mathematics And Science Study. (2015). Achievement in mathematics content domains. boston: international study center lynch school of education, Boston College.

Juanda, M. Johar, R., Ikhsan, M. (2014). *Peningkatan kemampuan pemecahan masalah dan komunikasi matematis siswa smp melalui model pembelajaran means-ends analysis (mea)* [improvement of problem solving and mathematical communication skills for junior high school students through the means-ends analysis (mea) learning model]. *Kreano Journal of FPMIPA UNNES*, 5(2).

Nanang, A. (2016). *Berpikir kreatif matematis dan kemandirian belajar dalam pembelajaran berbasis masalah* [mathematical creative thinking and learning independence in problem-based learning]. *Mimbar Sekolah Dasar* [Elementary School Forum], 3(2), 171-182.

Nasution, PR (2017). *Perbedaan peningkatan kemampuan berpikir kreatif matematis dan kemandirian belajar siswa pada pembelajaran berbasis masalah dan pembelajaran konvensional di smpn 4 padangsidimpuan* [differences in increasing mathematical creative thinking ability and student learning independence in problem-based learning and conventional learning at smpn 4 padangsidimpuan]. *Paidagogeo Journal*, 2(1), ISSN: 2527-9696.

Octaviana, D., & Kurniasih. AW (2020). Mathematical creative thinking skills of eighth grade in terms of learning styles on learning model means-ends analysis (MEA). *Unnes Journal of Mathematics Education (UJME), 9(1)*, 74-82.

Permatasari, GA, Veronica, RB, & Susilo, EB (2013). *Keefektifan pembelajaran problem posing dengan pendekatan pmri terhadap kemampuan berpikir kreatif siswa* [the effectiveness of problem posing learning with the pmri approach on students' creative thinking ability]. *UJME: Unnes Journal of Mathematics Education, 2(1)*, 85-89.

Pribadi, A., Somakim, S., & Yusup, M. (2017). *Pengembangan soal penalaran model timss pada materi geometri dan pengukuran smp* [development of timss model reasoning problems in middle school geometry and measurement materials]. *Histograms*, 1(2).

Sidik, MA, Desmayanasari, D., & Noprisa. (2020). *Pengembangan soal penalaran model timss pada materi geometri dan pengukuran smp* [students' mathematical creative thinking ability using open-ended learning model. Hipotenusa journal of research mathematics education], 3(1), 2621-0630.

Solikah, A. & Himmah, WA (2019). *Keefektifan model pembelajaran means ends analysis dengan strategi heuristik terhadap kemampuan pemecahan masalah matematika* [the effectiveness of the means ends analysis learning model with heuristic strategies on mathematical problem solving ability]. Jurnal Hipotesnusa, 1(1), 1-8.

Sugiyono. (2015). Educational research methods quantitative, qualitative, and rnd approaches. Bandung: Alphabet.

Susanti, A., Susanta, A. & Muchlis EE (2019). Comparison of learning outcomes between the means ends analysis (mea) learning model and expository learning. Journal of Mathematics Learning Research (JP2MS), 3(2), 242 -250.

Zulkardi. (2002). Developing a learning environment on realistic mathematics education for Indonesian student teachers. Unpublished dissertation. Enschede: University of Twente.