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Student Critical Thinking Viewed from Mathematical Self-efficacy in Means Ends Analysis Learning with the Realistic Mathematics Education Approach

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Abstract

This research aimed to determine the effectiveness of learning by using the MEA model RME approach to the students' critical thinking skills, and analyzedthe students' critical thinking skills based on students' mathematical self-efficacy.The research was conducted at SMP 1 Wedarijaksa, Pati, Central Java. Method used in this reaserch is mix method with concurrent embedded model. The sample in this research were the students ofVII I and VII C. Research findings showed learning by using the MEA model approach to the RME was effective to the students' critical thinking skills. Critical thinking skills of mathematics towards mathematical self-efficacy, students with high mathematical self-efficacy were able to achieve the five aspects of critical thinking skills, namely drawing conclusions, assumptions, deductions, interpreting information and analyzing arguments. Students with mathematical self-efficacy have been able to achieve four aspects of critical thinking skills namely drawing conclusions, deductions, interpreting information and analyzing arguments. Students with low mathematical self-efficacy were only able to achieve two aspects of critical thinking skills, namely drawing conclusions and analyzing arguments.

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INTRODUCTION

Thinking is one of the activitiesthat wascarried out by humans whichresults in discovery for a particular purpose. Facing the current era of globalization requires high-level thinking of each individual, because the current era of technology, competition in education, the nation's economy is growing rapidly. One of the higher-order thinking skills is critical thinking.Responding to this requires critical thinking habits. In the field of education, critical thinking can be developed inmathematics in the school and university. In accordance with the competencies that must be achieved in learning mathematics according to the Minister of Education and Culture Decree No. 64 of 2013 concerning the Content Standards for Primary and Secondary Education is logical, critical, analytical, creative, critical, careful and thorough, responsible, responsive, and not easily give up in solving problems. Thinking skills are needed to analyze problems so that they get a solution. According to Enis (Daniel, 2016: 7) critical thinking is an activity of thinking that must be reasonable and sensiblebased on the decisions which is trusted and believed to determine what is done.Maftukhin (2014) revealed that the ability to think critically is an ability that must be done by students in learning mathematics, critical thinking has an important role in the creativity of students.

When thinking critically, someone will go through a stage of thinking. Critical thinking stage was also stated by Ennis (Sulianto, 2008) that there are six basic things in critical thinking, namely focus, reason,inference, situation, clarity, and overview.Setyawati (2013) states that the characteristics of someone critical thinking are: (1) resolving a problem with a specific goal, (2) analyzing, generalizing, organizing ideas based on existing facts / information, and (3) drawing conclusions in solving the problem systematically with the correct argument. There are several ways to measure critical thinking skills, one of which and also used in this study is a test which is similar to WGCTA with the indicators in the opinion expressed by Watson and Glaser. The critical thinking indicators proposed by Watson and Glaser (2008) include: (1) inference making in the form of conclusions drawn from various facts that have been observed or appropriate conditions, (2) recognition of assumptions are something that is relied on or taken for granted, (3) deduction, (4) interpreting information, (5) evaluating of arguments, which can distinguish strong arguments and weak arguments.

Mathematics is an abstract science with reasoning that requires logic in its statement equipped with evidence through problem solving activities. The problem solving activities make students think, so they can develop critical thinking of students. Critical thinking students can be trained by giving mathematical problems to be solved.Activitieslearning in schools more often teach students by giving one correct answer so that students cannot develop their thinking by raising new ideas according to their abilities. Students become unable to freely express their thoughts on problems so students cannot develop critical thinking. Research conducted by Santrock (2011) also revealed that there were still few schools that taught and developed critical thinking skills in learning. The results of observations made by researcheralso concluded that the ability to think critically is still low. This was indicated from the results of observations which show that only 23.33% of students could work on math critical thinking problems and as many as 76.67% of students still could not solve the problems that were given.The researcher also analyzed the questions commonly used during the test.

The Research was conducted by Daniel (2016) showed that students' critical thinking skills were still low. The result of his research was that the eighth grade students still had difficulty in mastering the material on the flat side space because students were not accustomed being critical in solving non-routine questions so that the students' mathematical abilities were low. Non-routine questions are questions that require follow-up in their settlement, such as giving an argument about the solution they provide so students can get accustomedcritical thinking skills.Beside critical thinking, students'confidences also influence the success in solving a problem that was given. Critical thinking basically can foster a person's self-efficacy. The one that determine self-efficacy is how someone thingking. Self-efficacy is self-confidence in one's ability to organize and carry out an activity to achieve the expected goals, (Bandura, 1997; Hendriana et al., 2017). Self-efficacy in students is an assessment of students' self-ability in managing and implementing various kinds of academic tasks provided by the teacher. Assessment of one's ability in mathematics learning activities can

be called mathematical self-efficacy. Mathematical self-efficacy is a student's belief in his ability to organize and carry out mathematics learning activities. Achieving a certain goal by predicting how much effort is needed to achieve that goal is contained in magnitude, level and strength dimensions. The high level of mathematical ability of students is also influenced by students self-efficacy, Dewanto revealed (in Hasibuan, 2016).

One of the ways to support the success of learning activities is by selecting the learning model and the right approach. One of learning model that is suitable with the development of students critical thinking skills is the Means-Ends Analysis (MEA) model. This learning model will make the students are easier in critical thinking because it is presented some questions to solve a problem by the teacher. This is indicated by research doing by Nurafiah, et al. (2013) where the results of the study concluded that there was an increase in critical thinking skills of students who received treatment with MEA learning.MEA learning model is a learning model of variation between problem solving models with syntax that presents the material on a heuristic based problem solving approach, which is a series of questions which are the instructions to help students solve problems that were given (Huda, 2014). The syntax of the MEA learning modelare: 1) Identifyingthe differences of current stateand goal state. At this stage students understand the basic concepts of learning contained in the problem faced. 2) Organisingsub goals. The stage where students have to arrange subgoals to solve problems. 3) Selecting the operators or solutions. This stage if the subgoals of students have been formed then students will be asked to think about the concepts and if the subgoals have been solved then students can find a solution in solving the problems that were given (Herawanti&Mintohari, 2017)

The learning model can be collaborated with the Realistic learning approach.Realistic Mathematics Education (RME) is approach to learning mathematics that oriented to everyday experience and applying mathematics in everyday life(Sugesti et al., 2014).Research conducted by Devrim and Uyangor (Sugesti et al., 2014) suggests that realistic problems are used as a source of the emergence of mathematical concepts or mathematical knowledge so as to influence the improvement of student learning achievement. According to Aristiyo et al. (2014) RME is a theory of learning and teaching in mathematics education which was first introduced and developed by the Freundenhal Institute in the Netherlands in 1970.According to Gravemijer(Julie, 2016) the RME approach also has characteristics that include: 1) Phenomenological exploration, 2) Bridging by vertical instruments, 3) Student contributions, 4) Interactivity, 5) Intertwining. The collaboration betweenMEA model and RME approach can support learning and facilitate students in solving problems or question given by the teacher because it presents problems where the problem is real or has been well imagined by students. The MEA model with the RME approach is a learning model that optimizes problem solving activities through a realistic approach. This model has series of questions; it is a guide to help students in solving questions. The problems that are given are also real or those that have been mastered can be well imagined by students.

Based on the description above, the purpose of this research was to identify the effectiveness of MEA model RME approach to students' critical thinking skills and to describe critical thinking skills based on mathematical self-efficacy of students in mathematics learning with the MEA model RME approach.

METHOD

This research used a research design that refers to a mixmethods with concurrent embedded research model. In this research quantitative research model as primary method and qualitative research model as secondary method. The research was conducted at SMP 1 Wedarijaksa, Pati, Central Java and the material that was taught was a triangle. The population in this research were all seventh grade students and the sample was students of class VII I as experiment class and VII C as control class.

The source of the data in this research was the results of tests of mathematical critical thinking skills, the results of mathematical self-efficacy tests, and the results of interviews with seventh grade students. The data that has been obtained would be described in the learning process of mathematics in grade VII and would be continued with a description of students critical thinking abilities in terms of mathematical self-efficacy. The technique for collecting the datawas consist of questionnaires, documentation, tests, and interviews. There were two kinds of test techniques in

this research, namely the test of critical thinking skills in mathematics to see students' critical thinking skills and non-tests, namely the provision of inventory mathematical self-efficacy to determine the dominant mathematical self-efficacy possessed by each student. Interviews were used to determine the level of credibility of students' critical thinking skills data. The instruments used have been validated by experts, and carried out a trial first to test the critical thinking skill to be more qualified. There were two data analyzes in this study, namely the prerequisite analysis in the form of normality, homogeneity, and average two-equality test as well as hypothesis test analysis, namely in the form of complete testing of averages, completenes of proportion test, average difference test, and proportion difference test. While, for qualitative data analysis passes the stages of data reduction, data presentation, and conclusion.

RESULT AND DISCUSSION

In learning using MEA model RME approached it is said to be effective against the ability to think critically in mathematics if: (1) The ability to think critically of students in the MEA model with the RME approach reaches the limit. (2) The completeness of the proportion in MEA models RME approach more than 75%. (3) The average critical thinking ability of students with MEA models RME approach is better than the average students' critical thinking skills with PBL models. (4) The proportion of completeness of critical thinking skills of students taught with MEA models RME approach is better than the proportion of students' completeness of critical thinking skills with PBL model.

Before learning by using the MEA model approach to RME, the students of research class were given critical thinking ability test in the beginning to find out the similarity of the average and find out the limitation of values of the two sample classes. After learning by using MEA model approach to RME, students would be given the test that was the final critical thinking ability test. The results of the recapitulation of the tests of mathematical critical thinking skills in the experimental class and control class were presented in Table 1.

Table 1. The Recapitulation Result of Mathematical Critical Thinking Skills

No	Description	Experimental Class	Control Class
1	Average	82.69	72.82
2	High score	97	92
3	Low Score	64	42
4	Standar deviasi	9.60	13.74
	Student who completed on average	24	19
	Student who not completed on average	2	9

After the first effectiveness test was done which the test of the completeness of critical thinking skills in mathematics based on the predetermined deadline by obtaining a limit value was 74, the average due diligence was analyzed with T-Test. Based on the completeness test obtained $t_{value} > t_{table} = 4{,}615 >$ 1,708which means that $H_0$was rejected. So it can be concluded that the average value of critical thinking ability of experimental class students reaches the limit.The second test was the classical completeness test which aim to find out the students' proportion who was taugh by using the MEA modelapproach to RME that meets the limit of 75% of the total of students. Based on the z test, it wasfound that z_{value} = 2.059, meaning that H_0wasrejected because $z_{value} > Z_{table}$ = 2.059> 1.645. So it can be concluded that the proportion of students taught by using MEA model RME approach that meets the completeness limit has reached 75%.

The third test is the average difference test in this study using the Mann-Whitney test because after the prerequisite is done, the normality test shows that the data is not normally distributed. The test results obtained that z_{value} = -2,536 = 2,536, z_{table} = 1,645, then $H_0$is rejected and accept H_1because$z_{value} > z_{table}$ = 2,536> 1,645. So it can be concluded that the average critical thinking ability of students who are given MEA model RME approach is better than the average critical thinking skills of students given PBL.The fourth test was the proportion difference test which aimed to find out the difference in the number of students who achieve mastery of critical thinking skills taught using the MEA model RME approach

and the number of students who achieve the completeness of critical thinking skills taught by the PBL model. Based on the proportional difference test obtained z_{value} = 2,257 this means that $H_0$was rejected because $z_{value} > z_{table}$ = 2,257> 1,645, so it could be concluded that the proportion of student critical thinking abilities taught by MEA model RME approach is better than students critical thinking skills taught by the PBL model.Based on the effectiveness test fulfilling all these requirements, it was concluded that the MEA model with RME approach was effective against the ability to think critically in mathematics. This is in line with research conducted by Velo (2015) which shows that the RME approach is effective and contributes to increasing reasoning and mathematical generalizations to students.

The next problem is students' critical thinking skills in terms of mathematical self-efficacy in learning the MEA model RME approach. Data analysis was obtained from the results of questionnaires and interviews after being given the final test of critical thinking skills.At this stage the researcher first provided a mathematical self-efficacy questionnaire before the learning process conductedby using MEA model approach to RME. Then the results of the questionnaire were analyzed for the determination of the research subject. The research subject in this study was grouping students based on mathematical self-efficacy. Determination of research subjects selected 6 students with each category 2 students from the category of high mathematical self-efficacy, 2 students from the category of medium mathematical self-efficacy, and 2 students from the category of low mathematical self-efficacy. The subject of this research would be analyzed the critical thinking abilities possessed. Students' critical thinking skills refer to aspects or indicators of critical thinking abilities which include conclusions, assumptions, deductions, interpreting information, and analyzing arguments. Then an analysis would be conducted based on the results of the final test of critical thinking skills and interviews that have been conducted.

Students who belong to the category of high mathematical self-efficacy were able to solve the critical thinking ability problem that was given even though there were still some errors. Students who have high mathematical self-efficacy have been able to achieve the five aspects/indicators of critical thinking, namely conclusions, assumptions, deductions, interpreting information and analyzing arguments. This means mathematical self-efficacy was high, so students critical thinking skills was also highbecause it is able to properly resolve the five indicators on critical thinking skills. The result of this research is in line with the research conducted by Nadia (2017) that students with high self-efficacy can use all the indicators of mathematical representation maximally. They are able to express mathematical ideas in the form of mathematical representations to find solutions to a problem well despite errors, but not significant. Students who belong to the category of medium mathematical self-efficacy are able to fulfill four aspects of critical thinking skills, namely conclusions, deductions, interpreting information and analyzing arguments. Both of these students were still unable to solve the problem in terms of assumptions. There were still questions that could not be resolved and during the interview the two students could not provide reasons for solving problems related to the assumption aspects.

Students who belong to the category of low mathematical self-efficacy have not been fully able to solve all aspects of critical thinking skills contained in the problem. Questions on one indicator could be resolved but not perfect. But overall it can be concluded that students who have low mathematical self-efficacy were only able to achieve two aspects of critical thinking skills, namely conclusions and analyzing arguments so that they still lack the ability to think critically.This is supported by the results of research conducted by Laela Vina Hari (2018) showing that students who low self-efficacy attitudes in mathematics will tend to work on problems in accordance with the knowledge gained and no desire to explore again. They also tend to depend on memorization so that they become low in decision making during the problem solving process.

CONCLUSIONS AND SUGGESTIONS

The conclusions obtained are based on the results of the analysis and discussion, namely learning by using the MEA model the RME approach is effective against students' critical thinking skills. After further analysis of the critical thinking skills of mathematics towards mathematical self-efficacy, it is known that students with high mathematical self-efficacy were able to achieve the five aspects of

critical thinking skills, namely conclusions, assumptions, deductions, interpreting information and analyzing arguments. Students with medium mathematical self-efficacy were able to achieve four aspects of critical thinking skills namely conclusions, deductions, interpreting information and analyzing arguments. Students with low mathematical self-efficacy were only able to achieve two aspects of critical thinking skills, namely conclusions and analyzing arguments. So it can be concluded that students with high critical thinking abilities were also high in mathematical self-efficacy, while students with critical thinking skills were low, so their mathematical self-efficacy was also low. To practice the ability to think critically in learning, the teacher must habituare students with giving questions about the ability to think critically and pay attention to the mathematical self-efficacy that each student has.

REFFENCES

Aristiyo, D. N., Rochmad.,Kartono. 2014. "PembelajaranMatematika Model IKRAR Berpendekatan RME untukMeningkatkanKemampuanRepresentasi Matematika". *UJMER*, 3(2): 110-115

Daniel, F. 2016. "KemampuanBerpikirKritisSiswapadaImplementasi Project Based Learning (PjBL) BerpendekatanSaintifik".*JurnalPendidikanMatematika Indonesia*, 1(1): 7-13.

Hari, L. V., Zanthy L. S., Hendriana, H. 2018. "Pengaruh*Self Efficacy* TerhadapKemampuanBerpikirKritisMatematikSiswa SMP". *JurnalPendidikanMatematika Indonesia*, 1(3): 2614-2155.

Hasibuan, N.H. 2016. "Perbedaan Self-Efficacy MatematisSiswaantaraPembelajaranBerbasisMasalahBerbantuanGeogebradan Autograph di MAN 1 Medan". *Jurnal Pythagoras*, 5(2):165-171.

Hendriana, H., Rohaeti, E.E., Sumarmo, U. 2017. *Hard Skills dan Soft Skills MatemaikSiswa*. Bandung: RefikaAditama.

Herawanti, U. S. P., Mintohari. 2017. "Pengaruh Model Pembelajaran MEA *(Means Ends Analysis)*TerhadapHasilBelajarSiswaKelas IV SD Kebraon 1 Surabaya". *JPGSD*, 4(3): 621-630.

Huda, M. 2014. *Model-Model PengajarandanPembelajaran*. Yogyakarta: PustakaPelajar.

Julie, H. 2016. "Karakteristik Intertwining dalamPendekatanMatematikaRealistik di SekolahDasar".*JurnalSekolahDasar*, 25(2): 109-120.

Maftukhin, M., Dwijanto.2014." Keefektifan Model Pembelajaran Creative Problem Solving Berbantuan CD PembelajaranTerhadapKemampuanBerpikirKritis".*UJME*, 3(1): 30-34.

Nadia, L. N., Waluya, B., Isnarto. 2017. "AnalisisKemampuanRepresentasiMatematis Ditinjaudari*Self-Efficacy*PesertaDidikmelalui Inductive Discovery Learning". *UJMER*, 6(2): 242-250.

Nurafiah, F., Nurlaelah, E., Sispiyati, R. 2013."PerbandinganPeningkatanKemampuan BerpikirKritisSiswa SMP antara yang MemperolehPembelajaran Means-Ends Analysis (MEA) dan Problem Based Learning (PBL)".*JurnalPengajaran MIPA*, 18(1): 1-8.

Permendikbud.2013. *Standar Isi PendidikanDasardanMenengah*. Jakarta: KementrianPendidikandanKebudayaanRepublik Indonesia

Santrock, J.W. 2011. *Life-Span Development, PerkembanganMasaHidupJilid 1 (EdisiKelima)*.Jakarta:Erlangga.

Setyawati. 2013. "PengembanganPerangkatPembelajaranMatematika Model Problem Based Learning BerorientasiEnterpreneurshipdanBerbantuan CD Interaktif". *Prosiding Seminar NasionalMatematika 2013*. Semarang: UniversitasNegeri Semarang.

Sugesti, F. E., Budiyono., Subanti, S. 2014. "Ekperimentasi Model PembelajaranKooperatifTipe Structured Numbered Heads (SNH) dan Two Stay Two Stray (TSTS) denganPendekatan Realistic Mathematics Education (RME) padaPrestasiBelajarMatematikaDitinjaudari Adversity Quotient (AQ) Siswa".*Jurnal of Mathematics and Mathematics Education*, 4(1): 1-10.

Sulianto, J. 2008. "PendekatanKontekstualdalamPembelajaran MatematikauntukMeningkatkanBerpikirKritis

PadaSiswaSekolahDasar".*Pythagoras*, 4(2): 14-24.

Veloo, A.,Ruzlan., Herwati. 2015. "Effect of Realistic Mathematics Education AprroachAmong Public Secondary School Student In Riau Indonesia". *Australian journal of basic and applied sciences*, 9(28): 131-135.

Watson, G., & Glaser, E. 2008. *Watson-Glaser Critical Thinking Appraisal: Short Form Manual*. USA: Pearson.