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Integrated Between DAPIC Problem Solving Model and RME Approach to Enhance Critical Thinking Ability and Self Confidence

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The goals of learning mathematics are to develop thinking skills. But the results showed that critical thinking ability are still low and the lack of self confidence of students. Therefore we need a supportive learning, alternative learning is DAPIC (Define, Assess, Plan, Implement, and Communicate) Problem Solving with Realistic Mathematics Education approach. This study aims to find out whether the use of DAPIC Problem Solving with Realistic Mathematics Education approach was effective in critical thinking ability and self confidence. The method used is pretest and posttest of a controlled group, where 67 middle school students are used as research sample. The instrument used are valid and reliable. First stage of examination is normality and homogeneity test. Meanwhile, the hypothesis is tested by analyzing the parametrical statistic of proportion test, proportion difference test, t-test, independent sample t-test, and regression test. The result showed that DAPIC Problem Solving with Realistic Mathematics Education approach was effective in critical thinking ability and self confidence. Based on the results, DAPIC Problem Solving with Realistic Mathematics Education approach can be used as a choice to improve student learning outcomes, especially critical thinking skills and self confidence.

Keywords: critical thinking ability, self confidence, dapic problem solving, realistic mathematics education

INTRODUCTION

Pacific Policy Research Center (2010) in United States said in the 21st century with existence of advanced technology to access, manipulate, analyse, manage, and communicate information requires critical thinking ability, while students critical thinking ability at middle school stage are still low. The learning model is also designed so that students actively develop their potensial. However, in the 21st century not only the students are required to be active during the learning process but also capable to develop their logical, analytical, systematical, critical and creative thinking so that they can analyze and communicate any information they got. Critical thinking is one of the higher order thinking skills component is the focus of 21st century learning. A survey involving fact and procedural in problem

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solving was brought by TIMSS (2015) to some student in 8th grade, according to the survey Indonesia placed at 44th out of 49 countries.

The process of learning mathematics is more dominant used critical thinking ability so necessary to develop the think of ability to solve the problems faced. George (2017) stated children aged 12-15 years have not been able to think abstractly so learning process required the presence of concrete objects so children can construct the knowledge they have acquired.

Research result from Azadi, Gholipour, & Habibollahi (2014) stated that a set of underlying cognitive abilities are involved in critical thinking and defined cognitive abilities asintellectual activities that create complex processes such as critical thinking, problem solving and decision. Shows that there is a link between self confidence and critical thinking ability, with increasing self confidence can make students critical thinking ability increase.

Based on Ennis (1985) stated that critical thinking is an activity that focuses on decisions about what is believed or through reflective thinking and reasoning activities. Nelson (2013) also stated that critical thinking is a concept involves cognitive skills and affective dispositions and affects the way teachers deliver concepts to students. This is needed so that students are able to revealed the processes that walk in their mind when problem solving. Indicators of critical thinking ability by Angelo (Seventika, Sukestiyarno & Mariani, 2018) is analyzing, synthesizing, recognizing and problem solving, concluding and assessing. On the other hand, explained that thinking it self starts by receiving data, processing and then storing it inside the memory, which later the memory will be used for further processing.

However, in order to solve a problem perfectly, students need psychological aspect, namely self confidence. A great self confidence will improve the ability of one's to think. As explained by Parsons, Croft, & Harrison (2011) the presence of self confidence allowing the students to communicate their opinions clearly. In other words, self confidence is needed to optimize the student's competency. Venkatarama & Reddy (2018) stated that self confidence is a belief that every individuals has the capability to make things work. At this point, a little bit out of context, we can safely say that self confidence is needed if any of you want to learn math, especially by solving its problems.

One of the learning alternatives to improve critical thinking ability and self confidence is DAPIC Problem solving with RME approach. This method encourages the students to solve their problem by developing their thinking ability and growing their confidence. As said by Rochmad, Kharis & Agoestanto (2018) the critical thinking ability allowing the students learn and sort out their problem systematically. DAPIC Problem Solving is a problem solving process that is developed by IMaST. Every component of DAPIC has a strong relation to each other, such as define, asses, plan, implement and communicate.

There are several key components in RME is problems, rediscovering, developing ability, and communicate. In DAPIC Problem Solving there are several key elements is define, asses, plan, implement, and communicate. Students with problem solving real problems and developed learning good, so students can construct their better knowledge. Ozdemir (2017) explains that the main goal of realistic mathematics education is to describe mathematics education to students by making students find mathematics. It can be said that RME is able to construct student's mathematics knowledge.

Results research of Sumirrattana, Makanong, & Thipkong (2017) about "Using realistic Mathematics Educations and the DAPIC Problem Solving Process to Enhance Secondary School Students Mathematical Literacy" showed that an increase in student mathematics literacy in RME and DAPIC Problem Solving learning. In this research will examined about DAPIC Problem Solving with RME approach able to developed critical thinking ability and increase self confidence of students.

Mathematics learning must make students more familiar with mathematical problem that solved with obtained mathematical knowledge previously so students can develop critical thinking ability. With RME approach or realistic mathematics education students can conneting mathematics in everyday life so students can develop their abilities well. Noviani, Syahputra, & Murad (2017) said RME is an approach in mathematics learning refers to contextual problems, so that the teacher can help the students to think critically, analytically, systematically and creatively. Critical thinking ability students must be accompanied by phychological aspects to contribute to the success of students in problem solving properly. The psychological aspect is self confidence. To optimize their abilities, students need self confidence.

Based the background of the problem, research discusses critical thinking ability and self confidence in solving problems using the DAPIC Problem Solving with RME approach. The purpose of this article is to find out effectiveness of the DAPIC Problem Solving with RME approach to critical thinking ability and self confidence.

METHOD

Research Design

This research uses a type of experiment called pre-experimental designs. Wherefore the research's goal as mentioned above is to find out the effectiveness of a certain treatment, then 'Control Group Pretest Posttest Design' will be used as this research design. Control Group Pretest Posttest Design is a design that uses two groups and control group as a comparison where the initial ability of the subject will be tested first, then given a treatment within the experimental group and lastly the critical thinking ability will be tested. The research design (Arikunto, 2013) is shown in Figure 1 below.

R_1:	$O_{1\_}$	X_1	$O_{2\_}$
R_2:	O_1	X_2	O_2

Figure 1
Control Group Pretest Posttest
With,
R_1 : Experiment Class
R_2 : Control Class
O_1 : Initial ability test
O_2 : Critical thinking ability test
X_1 : Treatment use DAPIC *Problem Solving* with RME approach.
X_2 : Treatment with Problem Based Learning.

The experiment class was treated use DAPIC *Problem Solving* with RME approach and control class used Problem Based Learning (PBL). The chart of research procedure in Figure 2.

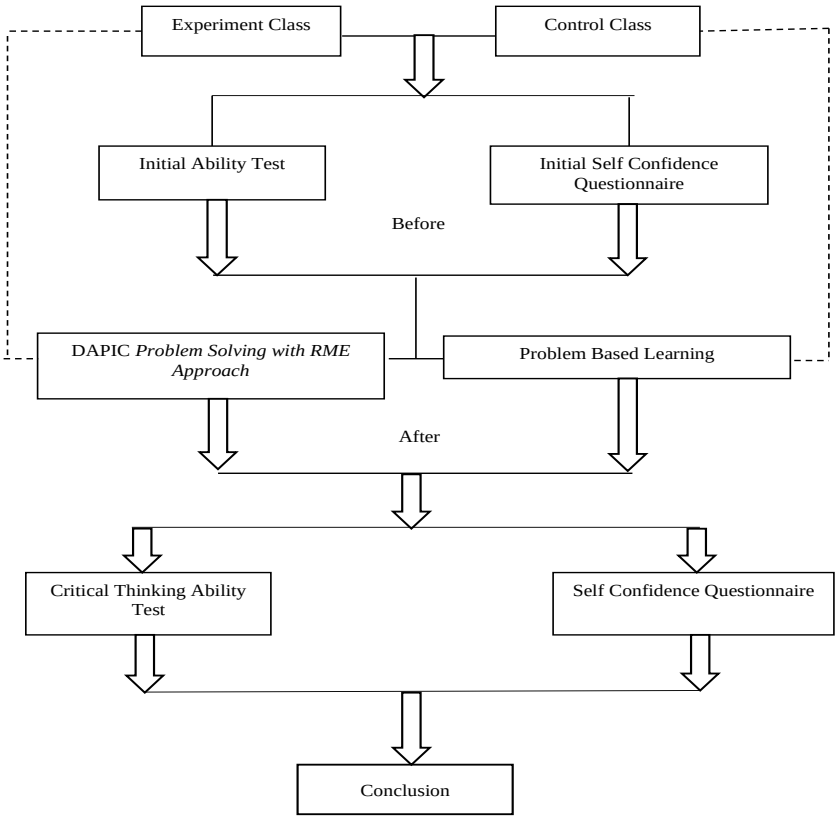

Figure 2
Research Procedure

Research was conducted with initial ability test and initial self confidence questionnaire followed by learning for four times learning use DAPIC Problem Solving with RME Approach the end of learning held critical thinking ability test and self confidence questionnaire.

The test consists of initial test of critical thinking ability to test initial ability students is obtained by giving 5 questions of initial mathematical ability students test. And test of critical thinking ability after activities using DAPIC Problem Solving with RME Approach by giving 5 questions of critical thinking ability.

Questionnaire aims to obtain students of self confidence scores in DAPIC Problem Solving with RME Approach learning. Intial self confidence questionnaire was measured by giving 30 statements related to self confidence students before learning and the final questionnaire to find out how the level of self confidence after learning process.

Population in this research was VIII grade students at SMPN 3 Sindang Indramayu in the 2018/2019 academic year consisting of seven classes. This research used nonprobability sampling. Samples were taken using cluster random sampling is a sampling technique from individual groups of population conduced random so that each individual group of population has same opportunity to be selected. From seven class VIII in SMP N 3 Sindang Indramayu tested for normality and homogeneity obtained class VIII A as a control with Problem Based Learning and class VIII B as experiment class with DAPIC Problem Solving with RME approach and total sample is 68 students.

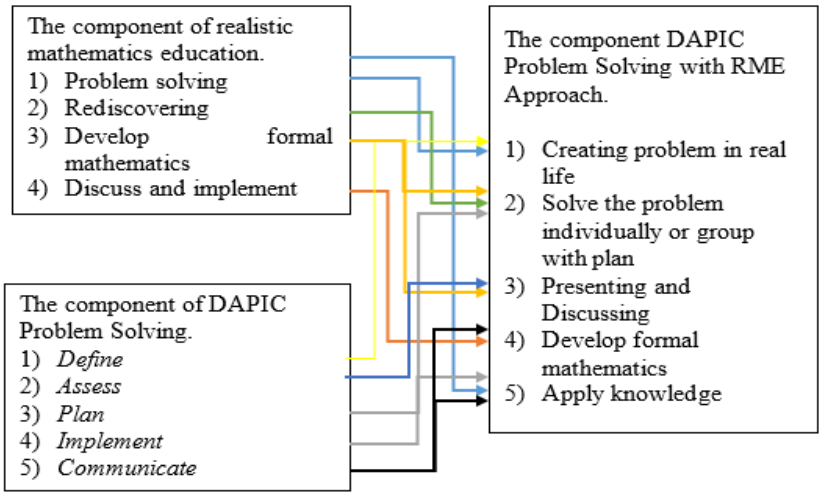

Figure 3
DAPIC Problem Solving and RME Approach Syntax

Development of learning process to improve the critical thinking ability by using realistic mathematics education and DAPIC Problem Solving Process, the researcher uses an instructional process development by Sumirattana (2017) whose development is presented in Figure 3.

DAPIC Problem Solving with RME Approach learning process can be explained below.

1. Create problems in real life, this step focuses on real life problems into mathematical topics that various solving problems, as analyse and define problems.
2. Solve problems individually or group with plan, this step focuses on collecting data related problems and assessing problem situations to plan solutions.
3. Present and discuss, this step focuses on presenting and discussing how to solve problem and solutions.
4. Develop formal mathematics, this step focuses on solving problems and discussing methods that lead to the formulation of a solution.
5. Apply knowledge, this step focuses on apllying mathematical conceptual and procedural knowledge developedto solve various problems and problems in real life situations.

Data Analysis

Data sampling technic is completed using two stages, thay are test and questionnaire. The test itself consist of initial critical thinking competency test and final test after DAPIC Problem Solving with RME approach treatment implemented. Meanwhile, the questionnaire is used to obtain self confidence score in learning DAPIC Problem Solving with RME approach method.

According to Russefendi (2010), the test questions that are in the form of descriptive text or essay will generate a critical trait and only the students that understand the problem thoroughly can give a proper solution. The test given to the students consist of ten mathematically critical thinking questions, and must be analyzed critically in order that meet the specified criteria.

The questionnaire used by the researcher consist of 30 questions related to self confidence, analyzed with ‘likert’ scale. The questionnaire was adapted by Lauster (2015) and will be validated by

psychologists. Alwan, Hedri & Darmaji (2017) state that 'likert' scale is able to evaluate the gesture or attitude by giving out some questions to respondents. Data analysis technic involving initial data test analysis is normality test using Kolmogorov Smirnov test, homogeneity test using levene test and average similarity test using Independent Sample t-test. Last but not least, the hypothesis will be tested using Z-proportional test, proportional difference test and reaction test.

FINDINGS

Based on results of research and data collection, it get initial ability test and critical thinking ability test, score of initial self confidence and score self confidence. Initial ability test data and initial self confidence use to normality test, homogeneity test, average similarity test, and also to determine the Actual Passing Grade (APG).

Results of initial data analysis test used normality test with Kolmogorov Smirnov Test with $sig = 0.200 > 0.05$ so data of initial ability and self confidence came from a normally distributed population and result of Homogeneity test with F Levene Test with $sig = 0.906 > 0.05$ so data variance came from populations homogeny. Average similarity test used Independent Sample t test prodeces a significance values for initial ability test is 0.665. So $0.665 > 0.05$ so average initial ability of experiment class is same with average initial ability of control class. And the result of APL for critical thinking ability is 68 and APL for self confidence is 67.

After the pre-condition analysis is fulfilled, the hypothesis to find out the effectiveness of DAPIC Problem Solving with RME approach towards critical thinking ability and self confidence is tested. Each value is consistent towards scoring guideline of critical thinking ability and self confidence. The statistical data of critical thinking ability and self confidence is shown by Table 1,

Table 1
Score Critical Thinking Ability and Self Confidence

Group	Ability	Statistic		
		Maximum Score	Minimum Score	Mean
Experiment	Critical Thinking Ability	96.00	74.00	83.66
	Self Confidence	89.33	66.67	77.98
Control	Critical Thinking Ability	78.00	58.00	69.33
	Self Confidence	80.00	64.00	69.96

The results test of critical thinking ability and self confidence from experiment class and control class on Table 1 show the average test of critical thinking ability and self confidence in experiment class is better than the control class with average score is 83.66. Significant difference seen from results of average critical thinking ability the control class is 69.33, indicating a difference of 14.33 between two class. Average score self confidence from experiment class is better than the control class. Difference in self confidence score is 8.02 between two classes.

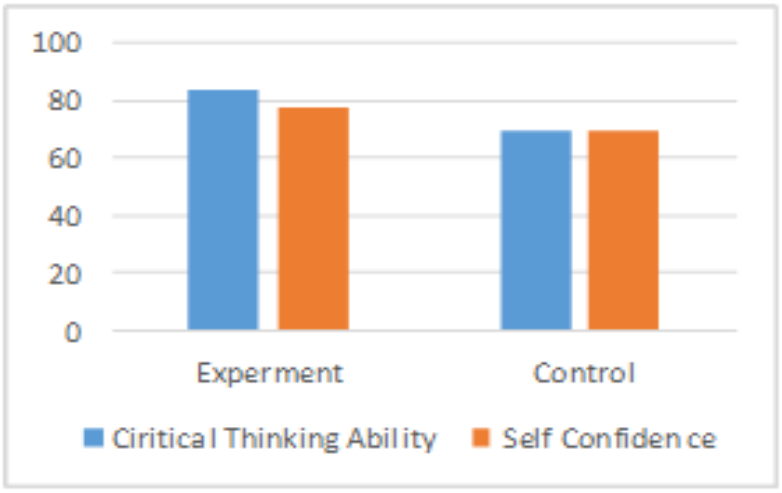

Figure 3
Results of Critical Thinking Ability and Self Confidence

Based Figure 3, critical thinking ability of experiment class has better than the control class. This is because during learning students are accustomed to answering critical thinking so their abilities increase. Self confidence has not significant difference because the learning both in experiment class and control class based on group discussions, but the results of self confidence in experiment class better than control class because students continue ask question about solve problem and present in the front of class. The result of hypothesis test is showed in Table 2.

Table 2
Result Hypothesis Test

Hypothesis Test	Variable	Count	Table
Proportion Z Test	Critical Thinking Ability	$z_{count} = 3.41$	$z_{table} = 1.64$
	Self Confidence	$z_{count} = 3.02$	$z_{table} = 1.64$
Diffirence Proportion Test	Critical Thinking Ability	$z_{count} = 3.53$	$z_{table} = 1.64$
	Self Confidence	$z_{count} = 1.82$	$z_{table} = 1.64$
T-Test	Critical Thinking Ability	$t_{count} = 19.92$	$t_{table} = 1.68$
	Self Confidence	$t_{count} = 13.57$	$t_{table} = 1.68$
Difference T-Test	Critical Thinking Ability	$t_{count} = 10.74$	$t_{table} = 1.67$
	Self Confidence	$t_{count} = 13.55$	$t_{table} = 1.67$

Calculation of Z proportion test on critical thinking ability is $z_{count} = 3.41$ and $z_{table} = 1.64$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means the proportion students achieve of critical thinking ability in DAPIC Problem Solving with RME approach more than 75%. Result on self confidence is $z_{count} = 3.02$ and $z_{table} = 1.64$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means the proportion students achieve of self confidence in DAPIC Problem Solving with RME approach more than 75%.

Calculation of difference proportion test on critical thinking ability is value of $z_{count} = 3.53$ and $z_{table} = 1.64$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means the proportion of students critical thinking ability on DAPIC Problem Solving with RME approach is more than proportion students critical thinking ability on PBL. Result on self confidence is is $z_{count} = 1.82$ and $z_{table} = 1.64$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means the proportion of students self confidence on DAPIC Problem Solving with RME approach is more than proportion students self confidence on PBL.

Calculation of t test on critical thinking ability is $t_{count} = 19.92$ and $t_{table} = 1.68$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means that average value critical thinking ability more than APL or 68. Result on self confidence is $t_{count} = 13.57$ and $t_{table} = 1.68$ with significance level is 5%. So, $z_{count} > z_{table}$ then reject H_0 and accept H_1. Means that average value self confidence more than APL or 67.

Calculation of difference t test on critical thinking ability is $t_{count} = 10.74$ and $t_{table} = 1.67$ with significance level is 5%. So, $t_{count} > t_{table}$ then reject H_0 and accept H_1. Means that average critical thinking ability of student in DAPIC Problem Solving with RME approach is more than average students critical thinking ability on PBL. Result on self confidence is $t_{count} = 13.55$ and $t_{table} = 1.67$ with significance level is 5%. So, $t_{count} > t_{table}$ then reject H_0 and accept H_1. Means that average self confidence of student in DAPIC Problem Solving with RME approach is more than average students self confidence on PBL.

Calculation test of effect self confidence on critical thinking ability used regression linier test. Results test is value of significance $0.000 < 0.05$. So, reject H_0. Means that there is effect of self confidence on critical thinking ability in DAPIC Problem Solving with RME approach. Based the regression linier test there $RSquare = 0.939$, means that self confidence variable influences critical thinking ability is 93.9% and 6.10% is influenced by other variable.

CONCLUSION

According to the observation result and discussion, can be concluded that the utilization of DAPIC Problem Solving with RME approach is effective to improve the critical thinking ability and self confidence. The utilization of DAPIC Problem Solving with RME approach can be implemented in learning math, not only on geometry part but also other subject materials and it is expected that DAPIC Problem Solving with RME approach can also be used in other subject studies.

It was found that stage of DAPIC Problem Solving with RME Approach learning can to develop critical thinking ability and foster self confidence through the problems of daily life. Define is the initial stage to define or identify the problem given in accordance with existing data. Asses is stage of assessing a given problem. Plan is the students stage in planning how to solve a given problem, step by step in solving the problem. Implement is the stage of students apllying what the planned before they get satisfying results and reach desired conclusions. Communicate is the stage where students

communicate the results, they can ask questions or can correct the answers. The stage of DAPI can develop their critical thinking ability because the stage in accordance with indicators of critical thinking ability and appropriate for developing students critical thinking ability. And through the Communicate students are required to foster an attitude of self confidence. Students has the same opportunity in every lesson. Through this research, the DAPIC Problem Solving with RME approach can become a right model improve their critical thinking ability and self confidence.

DISCUSSION

Nieveen (Saefudin, Aviori, & Ayuningtyas, 2019) one of requirements for a quality learning model is effective or achieving learning goals. Effectiveness in achieving outcomes in critical thinking ability and self confidence in DAPIC Problem Solving with RME approach as a determinant of quality learning. Learning said to be effective if student learning outcomes achieve mastery learning individually or classically, and the learning that applied is better than conventional classroom learning, and has the effect of self confidence in critical thinking ability.

The results of the research above, shows DAPIC Problem Solving with RME approach is better for improving students learning outcomes compared to conventional learning. These results are supported by results of research by Summirattana (2017) stated that DAPIC Problem Solving and RME Approach learning is able to improve students thinking abilities. Retno, Rochmad, & Waluya (2018) said mathematics learning should make students more familiar with mathematical problems that were solved using mathematical knowledge that had been obtained so students critical thinking ability develop. This show the learning with DAPIC Problem Solving is able to make students critical with the problems they are receiving. According TIMSS (Isrok'atun, 2003; Delina, Afrilianto, & Rohaeti, 2018) students use realistic approach have high achievements. Learning is based on reality and environment to facilitate the learning process of mathematics, so to achieve better learning goals.

DAPIC Problem Solving with RME approach is encouraged students to use all the knowledge acquired, encourage critical thinking, find various ways to solve problems, increase student activeness, and connect problems around them. Through the stages of learning DAPI students will be able develop critical thinking ability where students can define, assess the problems, plan how to solve the problem, and implement plans that prepared to problem solving. The activities can improve learning outcome and critical thinking ability. Critical thinking ability is a process of thinking that leads students to decide what to do to reach the best conclusion. Sumarna, Wahyudin, & Herman (2017) said critical thinking is understanding the problems around and analysing the process to reach best conclusions.

Self confidence must be grown because it is important attitude in mathematics learning. The results of research showed students are confident in learning so they can develop ability with solve critical thinking ability. According Ficha (Haeruman, Rahayu, & Ambarwati, 2017) self confidence is a belief in ability of students so they are able to problem solving given a good and effective solution.

Students is embarrassed ask when they do not understand the lesson explained by teacher, students is embarrassed abot answering question because they are worried about being wrong, students is embarrassed about answering question in front of the class, and students cheat the exam because students are not sure their abilities. The attitude is a means that students not confidence in their own abilities. Based the result Kusrini & Prihartanti (2014) low self confidence being pessimistic in challenges, fearful, and hesitant in expressing opinions. On the other hands, if students on high self confidence students will not be embarrassed about teacher question or answering in front of class.

DAPIC Problem Solving with RME learning also fosters self confidence students. Through learning that guides students to discussing and present the result of their discussions (Communicate), students increase their self confidence step by step. Students with low self confidence are required to continue and believe what they are doing so that their self confidence increases. Self confidence has significant effect on critical thinking ability. In addition, students have self confidence have a critical nature in solve problems. Sofiana's opinion (Nurkholifah, Toheri, & Winarso, 2018) characterizes individual have self confidence if individual believe in their own abilities and realize their plan successfully and have positive thinking will have optimism attitude and will critically thinking. From the analysis of self confidence data has a positive effect on critical thinking ability, cause is according to Hendriana (2012) students have high confidence in mathematics to be more courageus in taking steps to solve problems and students have more ideas in problem solving. While students with low self confidence more on memorization.

Fruedenthal (Sumirattana, Makanong, & Thipkong, 2017) explains mathematics must be connected to everyday and relevant to people's live. DAPIC Problem Solving with RME Approach to develop critical thinking ability and foster self confidence throught the problems of daily life. Define is the initial stage to define so that at first the students define or identify the problem given according to existing data. Assess is the stage of assessing a given problem. Plan is stage of students planning how to solve the problem given, step by step in problem solving. Implement is the stage for students to apply what was previously planned so that they obtain statisfactory results and reach the desired conclusions. Communicate is the stage of students communicating the results obtained with their friends so that if students have difficulty being able to ask questions with friend or can straighten out the errorrs of answers obtained.

DAPIC Problem Solving with RME learning effective to critical thinking ability and self confidence outcomes is a achievement of learning outcomes, DAPIC Problem Solving with RME approach better than PBL, and the effect of self confidence in critical thinking ability.

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