THE DEVELOPMENT OF AN OPEN-ENDED APPROACH BASED ON MEANINGFUL LEARNING IN SOCIAL STUDIES TO IMPROVE THE CRITICAL THINKING ABILITY

Ahsan Sofyan
University of Borneo Tarakan
Email: ahsan@borneo.ac.id

Abstract: This research aims to see the implementation of open-ended approach based on meaningful learning in social studies to improve the critical thinking skills of elementary school students Ausubel's open-ended learning model is very appropriate to be applied to improve students' critical thinking ability, and this is following the objectives of the open-ended approach based on meaningful learning. The formulation of the problem in this study is how to develop, implement, and influence and impact of the application of the open-ended approach on social studies learning to improve students' critical thinking ability. The method used is research and development. The study sites are four elementary schools in Tarakan City, while the subjects of this study are teachers and high-class students (grades 4,5 and 6) using purposive sampling technique. The results of this study indicate this approach is appropriate to use based on the assessment of peers, expert lecturers, and teachers, effectively improving students' critical thinking skills seen from the application during the learning process that is the average value of the experimental class students is higher by 83.33 than the average control class students an average of 80.07 in the final model validation test. It can be concluded that open-ended learning model based on meaningful learning in social studies learning to improve students' critical thinking skills in the City of Tarakan can effectively improve the critical thinking skills of Primary School students in the City of Tarakan.
Keywords: *Open-ended approach based on meaningful learning; social studies learning; critical thinking ability.*

INTRODUCTION

Education is recognized as being able to instill new capacity for all people to learn science and skills so that productive human beings can be obtained. This is in line with Winarso & Hardyanti (2019) that education is an important role in the quality of human life. As stated by Notika (2018), especially in today's global era, intense competition cannot leave little room for us to improve the quality of our education. Education is also believed to be a vehicle to expand universal access and mobility in society both vertically and horizontally. It is through education that humans, in this case, students get the ability to manifest themselves and function fully by personal abilities in society, and with these abilities, students can participate in building a nation and state civilization. These goals and expectations can be realized if education is not only directed at the mastery and understanding of concepts or materials but on improving students' thinking abilities and skills by involving real student activities. One of the students' thinking skills needed to be improved is critical thinking.

As stated by Nio, Sukestiyarno, Waluya, Rochmad, Isnarto, & Manullang (2017), critical thinking is one aspect of the quality of educational attainment in the context of the nation's intellectual life and character development. According to Al-Mubaid (2014), critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action. Nelson (2013) adds that critical thinking needs to be integrated and emphasized in the curriculum so that students can learn the skills and apply it to improve their performance and reasoning ability.

According to Kowiyah (in Afifah & Agoestanto, 2020), teachers can improve students' critical thinking skills with one of the strategies namely through the activities of asking open-ended questions to students or commonly referred to as the open-ended approach. Moreover, Tuna & Incikabi (in Koriyah & Idris, 2015) state that critical thinking is needed in

order to be success. However, in reality, students' critical thinking is still low. This is due to teacher center application rather than students center which makes students not involved in learning classroom (Sakti, Hartanto, & Dharmayana, 2016). Besides, one indicator of student success in learning is an innovative teacher's teaching ability. This is in line with Sapta, Pakpahan, Sirait (2019), that the choice of learning approach becomes very important and must be adapted to students' thinking abilities. Another opinion is stated by Rhosyida, Trisniawati, & Putrianti (2018) that the main principle of learning is to provide a great opportunity so that students can develop the ability to think and manage this capability so that there is a meaningful learning.

The intended innovations are: First, the teacher is able to design learning strategies to improve the ability of individuals to work together to build social interaction in the surrounding environment that is able to communicate well with a sense of empathy; second, the teacher is able to design learning strategies using learning approaches that are appropriate to the learning environment of students. As stated by Kayaoğlu & Sağlamel (2013), to create such an environment, the teachers should be primarily attentive to students' interests and needs, and also organize teaching activities with students by providing opportunities to students.

Learning systems and strategies that are thought to improve students' critical thinking skills are the application of the open-ended learning approach, which is a learning that emphasizes the students' efforts to arrive at the answers rather than the truth or accuracy of the answers alone, students are faced with a problem having more correct answers from one, the teacher does not limit the way students solve, on the contrary, the teacher gives the discretion to search for and use various approaches to the problem. This is supported by Ibrahim & Widodo (2020) that open-ended problems help students develop and demonstrate critical thinking skills, even if the results are not optimal. Moreover, Fatah, Suryadi, Sabandar, & Turmudi (2016) argue that the openness which is classified into three types; the process is open, end products are open, and ways to develop are open, can improve students' critical thinking skills. This is supported by Gisbtarani & Rianasari (2021) that open-ended problems could provide students with a rich experience in interpreting problems and also allowed students to produce various solution

methods. Thus, as a follow up, research needs to be done to see the improvement of students' critical thinking skills, one alternative is to use the open-ended learning approach, in Social Studies elementary school learning, in terms of the development of social abilities, students are able to establish relationships with peers because at this age, it is powerful peer bond so it is considered sufficient to have a general basis of knowledge as a learning capital and apply it to the community later. As Notika (2018) argues that open-ended approach is an approach with the nature of openness, so it can more freely develop student communication skills. Based on the description above, there are several problems that arise, among others: How is the implementation of the open-ended approach based on meaningful learning in social studies to improve the critical thinking skills of elementary school students?

METHOD

This research is a research and development or "Research and development" (R&D). This research was conducted in April to December 2018 in the fifth grade SDN 016, SDN 045, and SDN 018 in the City of Tarakan. The research subjects consisted of subjects of feasibility/validation, limited trials, and extensive trials. The subject of the feasibility trial consisted of three peers, three expert lecturers, and three fifth grade teachers. Subjects for expert trials included three peers, one media expert lecturer, one material expert lecturer, one instrument expert lecturer, and two Primary School Class with five Teachers. The subjects of limited trials are 23 fifth grade students of SDN 016 Coastal of Tarakan City. The subjects of extensive trials are 34 fifth grade students of SDN 018 as the control class, and 23 fifth grade students of SDN 045 as the experimental class. The sampling technique uses a purposive technique. The development procedure used in this study uses ten steps proposed by Borg and Gall (1983). The intended procedure includes 10 (ten) stages, namely (1) a preliminary study, (2) planning, (3) development of an initial product draft, (4) initial trials, (5) revision of results, (6) extensive trials, and (7) refinement of more comprehensive trial results, (8) model validation test, (9) refinement of final validation results, (10) dissemination and implementation.

In the preliminary study stage, literature studies, field observations, and interviews with the fifth-grade elementary school teachers are carried out. In the planning stage, an analysis of

the structure of content, material, concepts, and learning objectives are carried out. The initial product preparation phase includes the preparation of learning tools in the form of lesson plans, standardized test questions, questionnaires, and assessment instruments. The devices arranged in the future, referred to as the initial product (draft one). The product validation stage includes the initial product assessment by three validators (peers, expert lecturers, and fifth-grade teachers). The results of the assessment and comments on draft one are then used for product revision to produce draft two. The limited test phase is carried out by testing draft two on a limited scale, as many as 23 students — limited trials using the experimental design of one group pretest-posttest design (Sugiyono, 2012). The results of the limited trial were subsequently used for the revision of draft two to produce draft 3. The broad trial phase consisted of the trial draft three in the experimental class and compared with the control class that used learning tools that were already in school. Extensive trials using a quasi-experimental method with a non-equivalent control group pretest-posttest design, which is a modification of Sugiyono (2012). The results of extensive trials are used for revision of draft three so that the final product is then distributed and further applied through the dissemination stage. Data collection techniques in this study include techniques for measuring critical thinking skills, including standardized tests and observations. The instruments used to collect data are divided into three types, each of which is used to meet the criteria of eligibility (validity), practicality, and

effectiveness. The instrument for measuring aspects of eligibility uses a product validation sheet. The instrument to measure practicality consisted of an observation sheet on the implementation of the lesson plan and student questionnaire responses to the learning model, standardized tests, and the learning process. Instruments to measure effectiveness consist of instruments to measure critical thinking skills in the form of standard questions and observation sheets, as well as instruments to measure aspects of knowledge in the form of questions in social studies material.

Data analysis in the form of comments, suggestions, and revisions during the trial process is analyzed descriptively qualitatively and concluded as input for revising the product being developed. Data analysis techniques in the form of expert response scores (product eligibility), student response scores, lesson plan implementation scores, and scores critical thinking skills.

Analysis of product validation results and student responses

Data analysis techniques for model validation learning is done with the following steps: (1) tabulate all data obtained from the validators for each assessment item available in the assessment instrument, (2) calculate the average total score of each component by using formula 1, and (3) change the average score into a value by category. Reference for changing the five-scale score according to Sukardjo (2012) is presented in Table 1.

Table 1. *Convert actual scores to scale of five*

Score Range (i)	Value	Category
$\overline{X}_i + 1,80\ SBi < X$	**A**	Very good
$\overline{X}_i + 0,60\ SB_i < X \leq \overline{X}_i + 1,80\ SB_i$	**B**	Well
$\overline{X}_i - 0,60\ SB_i < X \leq \overline{X}_i + 0,60\ SB_i$	**C**	Enough
$\overline{X}_i - 1,80\ SB_i < X \leq \overline{X}_i - 0,60\ SB_i$	**D**	Less
$X \leq \overline{X}_i - 1,80\ SB_i$	**E**	Very less

Information:
$\overline{X}_I$ = Average ideal score = ½ (ideal max score + ideal min score)
SB_i = The ideal standard score deposit = 1/6 (ideal max score - ideal min score)
X = Actual score

In this study, the learning model is said to be feasible to use for trials if the results of the

assessment of each learning device are at least in the excellent category with a B.

FINDINGS AND DISCUSSION
In connection with students' critical thinking abilities, the following results are described in measuring students' critical thinking skills, whose results are presented in the following table 2.

Table 2. *Limited tryouts of students' critical thinking skills*

Test	Limited Trial					
	1			2		
	N	Mean	Std	N	Mean	Std
Pre-test	34	65.2	3.23	23	66.91	2.93
Post-test	34	75.76	3.26	23	84.86	3.91

Based on Table 2, it can be seen that in a limited trial on the mean (mean) of 65.20, experienced an increase in a limited trial 2 of 66.9. As for the post-test in the limited test 1, the mean (mean) was 75.76 and experienced an increase in the limited trial 2 with a mean 84.86. The increase in the limited trial phase 1 and limited trial 2 is in the medium category, this is because the teacher has just begun testing the open-ended learning model based on meaningful learning Ausubel which according to the teacher is still rigid in the implementation of the class, so the learning process in the class has not been running in accordance with what is expected to implement the learning model in the learning plan.

At this stage, the initial thinking ability of teachers and students about social studies material with Ausubel's open-ended learning model has begun to develop, but teachers and students are required to develop thinking skills that originate from social studies learning with open-ended models based on learning Ausubel meaningfully to improve thinking skills critically used as a reference in social studies learning, so it needs to be fixed at a limited test stage. The findings of the limited test 1 and limited test 2, aspects of the ability to think subsequently improved in the form of providing learning resources in the form of questions about open problems that are happening and are associated with social studies learning material being studied so that students are able to reconstruct learning materials both individually and in groups, this is expected to have an impact on students' thinking abilities at a full test stage. At the full test stage, the implementation process was carried out in three elementary schools in Tarakan City, North Kalimantan Province, namely more full trials, one at SDN 018, more full two at SDN 016, and more full three at SDN 045. Descriptions of more full trial results are presented in Table 3.

Table 3. *More full trials 1, wider 2 and 3*

Test	More Full Trials								
	1			2			3		
	N	Mean	Stdv	N	Mean	Stdv	N	Mean	Stdv
Post-test	34	81.76	4.22	32	81.40	3.07	28	82.75	3.39

It is referring to table 3. It is identified that for a full trial, one a mean of 81.76 was obtained, whereas in the broader trial 2 obtained a mean of 81.40 From a full trial two continued with a broader trial three and a mean obtained from the test results from students' critical thinking skills of 82.75, meaning there is an increase from before; this shows that the teacher has begun to understand how to implement the open-ended Ausubel's learning model. This implementation can work well because before entering more full trials, teachers are educated on how to develop social teaching strategies using the open-ended Ausubel's learning model to improve students' critical thinking skills. Findings obtained when implementing the test model are limited, meeting it back to the teacher. Some notes developed in social studies learning use the open-ended learning model based on Ausubel's meaningful learning theory, including; the teacher is trained on how to find open problems that are happening in the community, how to relate these problems to the social studies learning material in accordance with the SKKD, the teacher is given several concepts and strategies for teaching social studies, then the teacher is trained on how to learn meaningful strategies and how to discuss and solve open problems together. At the fuller trial stage, the results of the mentoring or briefing conducted intensively to the teacher have had an impact on significantly increasing students' critical thinking skills, this can be seen from the comparison of the results of the limited post-test 2 where the average results of the students' critical thinking ability tests are at achievements of 81.40 whereas in trials broader 3 the average post-test of students was at achievements of 82.75. Based on the results of an increase in students' critical thinking skills at the full testing stage 3, the researcher decided to proceed to the final stages

of the model of learning model validation testing. It can be illustrated that the final model validation test was carried out at four different schools namely: SDN 018, SDN 016, SDN 045, and SDN 029, wherein each school the researchers used two classes namely one class as an experimental class and one class as a control class to implement the final model.

The final stage in the development of this Ausubel open-ended learning model, namely; the final model validation test, aims to improve students' critical thinking skills on aspects of critical thinking, creative, innovative, and soluble aspects. The validation stage of the final model was designed using the pre-test design post-test control group experimental design. Improved aspects of students' critical thinking skills at the final model validation test stages are illustrated in table 4.

Table 4. *Validation test final model aspects of students' critical thinking skills (class experiments)*

Test	Validation Test Final Models (Experiments)											
	1			**2**			**3**			**4**		
	N	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*
Pre Test	32	73.40	4.80	28	72.85	5.10	24	65.58	2.93	21	74.66	3.70
Post Test	32	81.40	3.07	28	82.75	3.39	24	80.33	5.14	21	83.33	3.35

Table 5. *Validation test final model aspects of students' critical thinking skills (control class)*

Test	Validation Test Final Models (Control)											
	1			**2**			**3**			**4**		
	N	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*	*N*	*Mean*	*Stdv*
Pre-test	27	71.66	4.70	20	66	2.31	23	74	4.35	28	72.82	5.36
Post-test	27	75.88	3.20	20	74.5	3.64	23	77.43	2.17	28	80.07	2.90

The table 4 and 5 show the results of students' critical thinking skills tests involving two learning groups, where the experimental group already used the open-ended learning model based on Ausubel's meaningful learning theory and the control group used the usual learning model. In the final model validation test 1, the average post-test of the experimental group reached 81.40 higher than the control group, which was an average of 75.88. Differences in the average test of students' critical thinking skills in the final model validation test 2, where the average post-test of the experimental class was 82.75 while the control group was 74.5. An increase also occurred in the final model validation test 3, where the average results of the experimental group test on the final validation test 3 averaged 80.33 higher than the control class which obtained an average of 77.43, then an increase also occurred in the final model validation test 4, where the average post-test of the experimental class was 83.33 higher than the control class which obtained an average of 80.07. Based on the overall results of the final model validation test, it was found that there were differences in the average test results of students' critical thinking skills, where the experimental class had higher average scores compared to the control class. This is because the experimental class is a class that has been trained both in terms of teachers and students when implementing the open-ended learning model based on Ausubel's meaningful learning theory while the control class implementing the open-ended Ausubel learning model is also developed through integration into the lesson plan (RPP). Thus, this has an impact on improving students' critical thinking skills in social studies learning by applying open-ended learning models based on meaningful Ausubel learning. To be more explicit, it can be seen in Figure 1. The average graph of students' critical thinking skills.
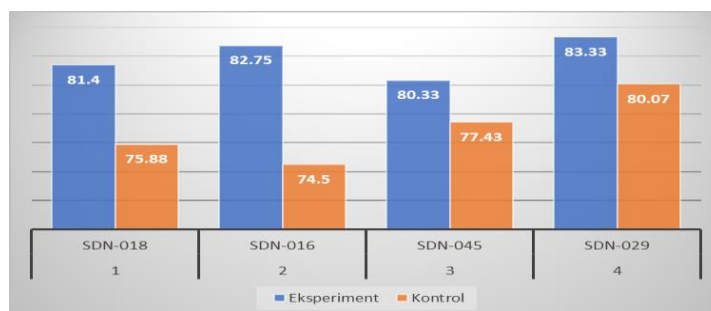

Figure 1. *Average graph of students' critical thinking skills*

Figure 1 explains that in the final model validation test there are differences in aspects of students' thinking ability between the experimental class and the control class, where the experimental class has increased in the final model validation test, while the control class in the final model validation test does not significantly increase the ability aspect students' critical thinking. The occurrence indicates that, on average, the experimental class using the open-ended learning model based on Ausubel's meaningful learning is better in terms of increasing students' critical thinking skills than the control class who did not use the open-ended learning model based on Ausubel's meaningful learning. In more detail, to see the differences in social studies learning outcomes using the open-ended Ausubel learning model on aspects of students' critical thinking abilities, a statistical test was carried out using the SPSS test assisted by version 24.

The results of the first stage (Preliminary Study), in the form of interviews, field surveys, and literature studies. The results of interviews and field surveys show that learning was conducted in an interactive lecture and learning activities were still teacher center, the learning process did not use worksheets, and the dominant learning source used was one of the publisher's textbooks — literature study results by reviewing the curriculum. The following are the results of the validation of the final model of the critical thinking skills of elementary school students, out of 105 elementary students from 4 schools spread across the City and Village / Coastal City of Tarakan. Data on critical thinking skills of students from 4 different elementary schools in the city of Tarakan above can be found differences in the average ability refers to the location of the school (Urban VS Rural) in the City of Tarakan, North Kalimantan Province. However, that it should be noted that in order to test the average difference between the two data groups, it is necessary to test the assumptions beforehand (Normality and Homogeneity Test) so that the selection of test types or statistical formulas become appropriate. For this reason, each statistical analysis below is presented in two assumptions tests and one statistical test in the following order: Normality Test, Homogeneity Test-t / Mann Whitney U Test.

Normality test
Statistical Hypothesis
H_0 = Normal Distributed Data
H_1 = Data is not normally distributed
Significance level
$\alpha = 5\%$
Test Criteria
H_0 is rejected if sig (p-value)
Analysis Results
Urban student data

Table 6. *Urban student data*

One-Sample Kolmogorov-Smirnov Test		Trk_City	Trk_Rural
N		60	45
Normal Parameters[a,b]	Mean	82.0333	81.7333
	Std. Deviation	3.27273	4.60928
Most Extreme Differences	Absolute	.291	.183
	Positive	.291	.097
	Negative	-.134	-.183
Test Statistic		.291	.183
Asymp. Sig. (2-tailed)		.000[c]	.001[c]
a. Test distribution is Normal.			

Interpretation
Because sig values for urban students = 0,000 < 0.05 and sig values for rural students = 0.001 < 0.5, it can be concluded that data from the two groups of students are not normally distributed.

Variant Homogeneity Test
Statistical hypothesis
H_0: The second variant is homogeneous data

H_1: The second variant of the data is not homogeneous
Significance level
$\alpha = 5\%$
Decision-making criteria
H_0 is rejected if sig $< a$
Analysis results

Table 7. *Test of homogeneity of variances*

Levene Statistic	df1	df2	Sig.
2.979	7	32	.016

Interpretation trk_kota
Because value of sig = 0,016 < 0,05 means the second variant of the data is not homogeneous

Mann Whitney U Test
Because the data is not normally distributed, a non-parametric statistical test was chosen, the Mann Whitney U test, as follows:
Statistical hypothesis
H_0: There is no difference in the distribution of critical scores between students in urban areas and students in rural areas.
H_1: There is a difference in the distribution of critical scores between students in urban areas and students in rural areas
Significance level
$\alpha = 5\%$
Decision making criteria
H_0 is rejected if sig
Test results

Table 8. *Test statistics*

	Critical_Results
Mann-Whitney U	1312.000
Wilcoxon W	3142.000
Z	-.250
Asymp. Sig. (2-tailed)	.803
a. Grouping Variable: Class	

Interpretation
Because sig = 0.803 > 0.05, H_0 is accepted, meaning that there is no difference in the proportion of critical scores between students who study in urban areas and students in rural areas. Next, to find out the difference in critical average scores between elementary schools in cities and primary schools in villages, the interpretation is as follows:

The T-Test (independent t-test)
Because the data is normally distributed, then the Independent t-test is chosen, as follows:

Statistics hypothesis
H_0: (There is no difference in the average Critical score between Students in the City and students in the Village)
H_1: (There is a difference in the average Critical score between Students in the City and students in the Village)
Significance level
$\alpha = 5\%$
Decision-making criteria
H_0 rejected if the value of sig
Test result

Table 9. *Independent samples test*

Independent Samples Test

		Levene's Test for Equality of Variances		-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Critical Results	Equal variances assumed	4.022	.048	.390	103	.697	.30000	.76912	-1.22536	1.82536
	Equal variances not assumed			.372	75.513	.711	.30000	.80662	-1.30669	1.90669

Interpretation
Because the value of *sig* = 0.048 > 0,05, then H_0 is accepted, meaning there is no difference in the average Critical score between Students in the City and students in the Village.

CONCLUSION

Based on the aims of the research and analysis of the results of the research development, it can be concluded that: (1) the open-ended learning model based on meaningful learning in social studies learning to improve students' critical thinking skills in elementary schools in Tarakan City is feasible based on the assessment of peers, expert lecturers, and teachers, (2) Open-ended learning model based on meaningful learning in social studies learning to improve students' critical thinking skills in the City of Tarakan can effectively improve the critical thinking skills of Primary School students in the City of Tarakan seen from the application of learning models in the learning process during research i.e. the experimental class students were higher than the control class students. The results of this study are expected as input for teachers in finding alternative ways of learning to create a situation that is conducive to the learning process. The results of this study are expected to motivate teachers to modify the way they teach. For further researchers, the results of this study are expected to be one of the bases and input in developing research through the open-ended learning approach.

REFERENCES

Afifah, S. A. & Agoestanto, A. (2020). Mathematical critical thinking ability in solving open-ended questions viewed from students' curiosity. *Unnes Journal of Mathematics Education, 9*(1), 36-42. doi: 10.15294/ujme.v9i1.38099

Al-Mubaid, H. (2014). *International Journal of Advanced Corporate Learning*, pp. 34-37.

Borg, W. R. & Gall, M. D. (1983). *Educational Research: An Introduction*, *Fifth Edition*. New York: Longman.

Fatah, A., Suryadi, D., Sabandar, J., & Turmudi. (2016). Open-ended approach: An effort in cultivating students' mathematical creative thinking ability and self-esteem in mathematics. *Journal on Mathematics Education, 7*(1), 9-18.

Gisbatarani, J. I., Rianasari, V. F. (2021). Analysis of creative thinking abilities of prospective mathematics teachers in solving and posing quadrilateral open-ended problems. *Indonesia Mathematics Education, 4*(1), p. 26-37

Ibrahim, I., & Widodo, S. A. (2020). Advocacy approach with open-ended problems to mathematical creative thinking ability. *Infinity,*

9(1), 93-102.

Kayaoğlu, M. N., & Sağlamel, H. (2013). Students' perceptions of language anxiety in speaking classes students' perceptions of language anxiety in speaking classes. *Journal of History Culture and Art Research, 2*(2), 142–160. Https://Doi.Org/10.7596/Taksad.V2i2.245

Koriyah, V. N. & Idris, H. (2015). Pengaruh open-ended terhadap prestasi belajar, berpikir kritis dan kepercayaan diri siswa SMP. *Pythagoras: Jurnal Pendidikan Matematika, 10*(1), 95-105.

Nelson. (2013). An impact of critical thinking on performance in mathematics among senior secondary school students. *Lagos State IOSR Journal of Research & Method in Education (IOSR-JRME),3*. pp. 18 http://www.iosrjournals.org/iosr-jrme/papers/Vol-3%20Issue-5/D0351825.pdf?id=7370 ,

Nio,T. H., Sukestiyarno, Y. L., Waluya, B., Rochmad., Isnarto., & Manullang, B. (2017). Study on critical thinking skills basic prospective students primary school teacher. *International Journal of Contemporary Applied Sciences, 4*(1), 54-70.

Notika, M. H. (2018). Development mathematics teaching-instrument learning using open-ended approach to improve mathematics communication ability and independent learning student. *Advances in Social Science, Education and Humanities Research (ASSEHR),* 285

Rhosyida, N., Trisniawati, Putrianti, F. G. (2018). Open ended approach: An exploration of critical thinking skill. *ICTSI*

Sakti, D. P., Hartanto, Dharmayana, I. W. (2015). Pengaruh pendekatan open-ended terhadap kemampuan berpikir kritis matematis siswa sekolah menengah kejuruan. *TRIADIK, 15*(2), 1-8

Sapta, A., Pakpahan, S. P., Sirait, S. (2019). Using the problem posing learning model based on open ended to improve mathematical critical thinking ability. *Journal of Research in Mathematics Trends and Technology, 1*(1), 12-15

Sugiyono, (2009). *Pendekatan Penelitian Pendidikan, Pendekatan Kuatitatif, Kualitatif, dan R & D*. Bandung: Alfabeta.

Winarso, W. & Hardyanti, P. (2018). Using the learning of reciprocal teaching based on open ended to improve mathematical critical thinking ability. *EduMa,8*(1).