Measuring Students Scientific Learning Perception and Critical Thinking Skill Using Paper-Based Testing: School and Gender Differences

https://doi.org/10.3991/ijet.v14i19.10968

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Abstract—This study aims to describe and test students' perception of scientific learning, students' critical thinking skill level in scientific learning, differences in perception and critical thinking skill level of students based on school differences and gender, and the influence of perception on students' critical thinking skill in scientific approach learning. It involved 206 students from three high schools in Banjarmasin, Indonesia. Quantitative data was obtained from a perception questionnaire and critical thinking skill test. The perception questionnaire refers to Perception of Science Classes Survey (PSCS). The test used refers to indicators of critical thinking skill from Ennis in 2011. Data were analyzed using nonparametric statistical tests with the SPSS version 23 application for Windows. The results showed that 1) students' perception of scientific learning were in the medium category, 2) students' critical thinking skill level was in a low category, 3) there were differences in perception and critical thinking skill level based on school, but there are not any differences found based on gender, 4) there was an influence of perception towards students' critical thinking skill in scientific learning approach. Designing innovative learning methods, involving student activity, and providing recommended learning facilities are suggested to do to enhance students' positive perception and critical thinking skill.

Keywords—Critical thinking skill, perception, scientific learning, paper-based testing

1 Introduction

Critical thinking skill is needed to deal with the development of science and technology [1-4]. This skill is used as a basis for problem-solving [3]. Through the ability

to think critically, someone can assess strengths and weaknesses of a development. Therefore, critical thinking skill is essential for 21st-century society.

The ability to think critically has become the focus of recent previous researchers in various countries as it is important and interesting to study and develop. They are such as [5] in Portugal, [6] in South Africa, [7] in Egypt, [8] in Thailand, [9-11] in America, [12] in Australia, and [13] in Canada. These previous researchers conclude that critical thinking is the focus of the important ability development that each individual needs in facing global challenges.

In recent years, Indonesian government especially in the educational field involved critical thinking skill. This can be seen in the learning objectives of Indonesian national curriculum [14,15]. Critical thinking skill is one of the standards of student learning completeness. Particularly in learning geography, one of the examples is requiring students to provide solutions to environmental problems [1]. The expected learning outcome is to foster an environmentally caring attitude of students.

In teaching and learning, the ability to think critically can be seen in the learning activities. This activity consists of eleven student activities which are divided into five abilities from basic to integration. Stages of basic abilities can be seen in activities of identifying and formulating, analyzing arguments, and clarifying. The basic stages of the decision consist of activities to assess the credibility of the source and report the results of observations. Stages of conclusions can be seen in the activity of assessing the results of work, composing hypotheses, and making decisions. The stages of advanced clarification consist of activities to connect unwritten assumptions. Finally, the stages of supposition and integration can be seen in the discussion activities to reconsider the reasons and revise the thought that is considered wrong [16,17].

It should be noted that students must possess critical thinking skill. This skill makes students able to evaluate and reflect on facts and data that they find through critical thinking [16,9]. Furthermore, through critical thinking, students can easily collect data for scientific investigations [18]. Therefore, students must be accustomed with the application of critical thinking skill. The habit of critical thinking in Indonesia itself is done through learning activities with a scientific approach. It can be exemplified by allowing students to carry out scientific investigations. This learning process includes formulating problems, conducting experiments, collecting data, and drawing conclusions [18]. The scientific learning process requires a source that is relevant, clear and reliable. To find out the validity of the source, it requires an assessment process to get the right answers [19,6].

One important step to improve critical thinking skill in scientific learning is knowing students' perception. By knowing students' perception of the scientific learning approach, the effectiveness of learning and efforts to develop critical thinking skill can be more efficient in the classroom [20, 21]. Several previous studies have developed instruments for measuring students' perception of scientific learning. One of them is [22] who developed the Perception of Science Classes Survey (PSCS) instrument based on a survey of 922 people aged 18-42 years. The indicators consist of six indicators, namely pedagogic strategy, interest in learning, student interest and perception of competence in learning, passive learning, the value of feedback, and laboratory experience. The other researchers, [23] developed an instrument of students'

perception of science learning in the Philippines. The instrument was tested in elementary and middle-class students. There are five indicators to measure the level of perception namely learning centers, investigations, influences and positive beliefs, the value of feedback, and support for learning and independent business.

To this far, studies conducted to reveal the relationship between students' perception and critical thinking skills in scientific learning are still scarce. Therefore, this study is an effort to complement the previous studies in measuring the perception, critical thinking skill, and the relationship between perception and critical thinking skill in scientific learning. The critical thinking skill itself is chosen as one of the indicators of measurement because this ability must be possessed by students so that learning can take place effectively and achieve the expected goals. The study of perception and critical thinking skill in scientific learning has not been done comprehensively. The quality of the implementation of learning can be seen from the level of students' ability to think critically during the learning process. Besides, this study is expected to be the first step in improving the quality of learning with a scientific learning approach.

This study aims to describe and test the influence of perception on critical thinking skill as an effort to improve the quality of scientific learning in Indonesia. The carried out research questions are: 1) How are students' perception of scientific learning in geography subject? 2) What is the students' critical thinking skill level in scientific learning? 3) Are there any differences in perception and levels of critical thinking skill in scientific learning based on school differences and gender? 4) Is there any influence of perception towards the critical thinking skill level in scientific learning?

2 Methodology

2.1 Research design

This study employed a quantitative approach. The data of this study was obtained from the answers to the scientific learning perception questionnaire and critical thinking skill test. The methods used were descriptive analysis method and linear regression analysis.

2.2 Participants

To find out the perception and critical thinking skill in scientific learning in geography subject, this study involved 206 students of Public High School in Banjarmasin, Indonesia. The students as research subjects were selected from three Public High Schools. The determination of grade was done by ranking the average national geography exam scores over the past five years (2013/2014 to 2017/2018) from the highest to the lowest, then classifying them based on three grades, namely high, medium, and low geography national examination scores. Based on the grouping of the three grades, Public High School A represented the high-grade schools with a number of 70 students, Public High School B represented the middle-grade schools with a total of

69 students, and Public High School C represented the low-grade with a total of 67 students. The students were taken from two classes in each school that almost have the same geography exam scores.

2.3 Instrument and procedures

Quantitative data was obtained from the perception questionnaire of scientific learning and critical thinking skill test. The questionnaire was adapted from the PSCS developed by [22]. This instrument was validated by the learning and language experts. It consists of 55 questions involving six factors namely pedagogic strategy, interest in learning, student interest and perception of competence, passive learning, the value of feedback, and laboratory experience. The PSCS uses a Likert scale with a range of 1 (strongly disagree) to 6 (strongly agree). Before the questionnaire was distributed, it was tried out on 30 students. The tried out results showed that the instrument used was valid and reliable with Cronbach alpha values> r table (0.970> 0.374). The time provided to answer the questionnaire was 15 minutes. The description of the instrument and the results of the validation are seen in Table 1.

Table 1. The Results of Instrument Validation of Student Perception in Scientific Learning

Item	F1	F2	F3	F4	F5	F6	Reliability
Pedagogical Strategies	.889						.877
Faculty Interest in Teaching		.942					.761
Student Interest and Perceived Competence in Science			.932				.796
Passive Learning				.921			.830
Grades as Feedback					.788		.861
Laboratory Experiences						.880	.850

Regarding critical thinking skill, it contained questions related to environmental problems. Assessment of the critical thinking skill on this test used the indicators of the critical thinking skill from [16]. Before answering the questions, students presented contextual problems taken from newspaper articles. The researcher's researchers developed this test, and two learning experts and linguists validated it. Before the test was used, the test was carried out in stage 1 on 30 students and stage 2 on 64 students with a total number of 10 valid questions. The reliability test results obtained Cronbach alpha results> r table (0.961> 0.2461). The details of the questions, indicators, and validity of the critical thinking skill are provided in Table 2.

Table 2. Questions, Indicators, and Validity of the Critical Thinking Skill Test

No.	Questions	Indicators	Validity	Reliability
1	What is the focus of the problem expressed in the article?	Basic classification	.936	.950
2	Why do these problems occur?		.637	.963
3	Are the supporting facts related to the problem?		.869	.953
4	Are you sure of the facts and data provided? What is your procedure for getting the data or facts?	Bases for a decision	.866	.953
5	Are you sure of the facts and data that you have found? How do you get the data and facts?		.798	.956
6	What is the best solution for problem-solving?	Inference	.723	.959
7	What are the advantages and disadvantages of the solution that you provide?		.831	.955
8	Are there difficulties in dealing with these problems?	Advanced classification	.775	,957
9	If the solution has a problem, is there any alternative solution that can be done? What is your basis for choosing the solution?	Supposition and Integration	.885	.952
10	What are the steps in working on alternative solutions given?		.914	.951

After testing the validity and reliability, the test was ready to be tried out in the field. The critical thinking skill test was carried out for 2x45 minutes. The maximum score for the critical thinking skills test was 100.

2.4 Data analysis

To answer the questions of perception criteria and critical thinking skill level in scientific learning, the questionnaire data and test were analyzed using descriptive analysis methods. Then, the data acquisition was calculated as the obtained average score. Finally, the results of the average score were divided into five categories given in Table 3.

Table 3. Criteria for Student Scientific Learning Perception and Critical Thinking Skill on Student Scientific Learning

Score		Criteria
Perception	***Critical Thinking Skill***	
55 - 109	0 - 20	Very low
110 - 164	21 - 40	Low
165 - 219	41 - 60	Medium
220 - 274	61 - 80	High
275 - 330	81 - 100	Very High

Mann-Whitney U nonparametric statistical analysis was used to answer the question of the influence of perception and the level of critical thinking skill on scientific learning based on gender differences. Meanwhile, the non-parametric Kruskal Wallis statistical analysis was used for the school differences. Furthermore, the nonparametric statistical test was carried out using simple linear regression analysis to answer the influence of perception on the level of critical thinking skill on scientific learning. All statistical analyses used were assisted with SPSS 23 for Windows.

3 Results

3.1 Student perception of scientific learning

After distributing questionnaires about students' perception of scientific learning, the results were analyzed and classified into five categories (very low, low, medium, high, and very high). A description of the perception level based on school and gender can be seen in Table 4.

Table 4. Student Perception Categories in Scientific Learning Based on School and Gender

Subject	Very Low		Low		Medium		High		Very High	
	N	***%***	***N***	***%***	***N***	***%***	***N***	***%***	***N***	***%***
A	0	0,00	1	1,43	36	51,43	32	45,71	1	1,43
B	2	2,90	5	7,25	39	56,52	21	30,43	2	2,90
C	10	14,93	34	50,75	20	29,85	3	4,48	0	0,00
Total Based on School	12	5,83	40	19,42	95	46,12	56	27,18	3	1,46
Male	7	6.09	22	19,13	54	46,96	30	26,09	2	1,74
Female	5	5.49	14	19,78	41	45,05	26	28,57	1	1,10
Total Based on Gender	12	5,83	40	19,42	95	46,12	56	27,18	3	1,46

Table 4 shows the percentage of perception of scientific learning in three schools. Sstudent's' perception of scientific learning was dominated by the medium category (46.12%) and only 1.46% was in the very high category. The average perception in the medium and high categories were 51.43% and 45.71% in Public High School A. Meanwhile, Public High School B was dominated by the medium category with a value of 56.52%. Furthermore, Public High School C was dominated by a low category with a number of 50.75%.

It is seen in Table 4 that the level of perception of students in scientific learning was in the medium category when viewed from the gender with a value of 46.12%. The perception of scientific learning when viewed from male students showed very high scores (1.74%), high (26.09%), medium (46.96%), low (19.13%), and very low (6.09). Whereas for female students the perception of categories was very high (1.10%), high (28.57%), medium (46.12%), low (19.42), and very low (5.83%).

3.2 Critical thinking skill on scientific learning

The problem in the second research question is the thinking skill of students in scientific learning. Critical thinking skill is important in the ongoing success of scientific learning. Critical thinking skill consists of five categories that are seen from school differences and gender. The ability to think critically viewed from school and gender differences is provided in Table 5.

Table 5. Descriptive Analysis of Students' Critical Thinking Skill Based on School and Gender Differences

Subject	Very Low		Low		Medium		High		Very High	
	%	*N*	*%*	*N*	*%*	*N*	*%*	*N*	*N*	*%*
A	0	0,00	16	22,86	36	51,43	15	21,43	3	4,29
B	0	0,00	39	56,52	27	39,13	3	4,35	0	0,00
C	2	2,99	47	70,15	15	22,39	3	4,48	0	0,00
Total Based on School	2	0,97	102	49,51	78	37,86	21	10,19	3	1,46
Male	2	1,74	55	47,83	45	39,13	11	9,57	2	1,74
Female	0	0,00	47	51,65	33	36,26	10	10,99	1	1,10
Total Based on Gender	2	0,97	102	49,51	78	37,86	21	10,19	3	1,46

At Public High School A, critical thinking skill was dominated by the medium category (51.43%). Public High School B was dominated by a low category (56.52%), and Public High School C was dominated by the low category (70.15%). Very high category was only found in Public High School A with a percentage of 4.29%. Meanwhile, the very low category was only found in Public High School C with a percentage of 2.299%.

The findings showed that male student was dominated by low category (47.83%). A similar thing was found in female students in the low category (51.65%). For all subjects, male and female students showed a tendency towards critical thinking skills in the low category (49.51%).

3.3 Perception and critical thinking skill based on school and gender differences

The next problem that was answered in the study was the influence of scientific learning perception on different schools. As the sschools were selected based on school grade and location, it was assumed that the location of the school created a different learning environment and influenced the ability of students in scientific learning. The number of students in Public High School A is 70, Public High School B is 69, and Public High School C is 67 students. The details of the perception influence of scientific learning on schools are provided in Table 6.

Table 6. Non-Parametric Statistics Test Results on Percepption of Scientific Learning Based on School Differences

School	N	Mean Rank	Chi-Square	Df	Asymp Sig.
A	70	141,80	99,182	2	0,000
B	69	121,28			
C	67	45,18			

Based on Table 6 it is known that there are differences based on different schools. The results of the Kruskal Wallis statistic test showed that the asymp-sig value was 0,000 <0,05. Details on each indicator of student perception about scientific learning based on school differences can be seen in Table 7.

Table 7. Kruskal Wallis Statistics Test Results on Perception Factors of Scientific Learning Based on School Differences

Factor	Mean Range			Chi-Square	df	Asymp. Sig
	A	*B*	*C*			
Pedagogical Strategies	131,06	139,06	38,01	120,592	2	0,000
Faculty Interest in Teaching	125,31	84,81	100,6	16,794	2	0,000
Student Interest and Perceived Competence	126,76	109,99	72,51	29,641	2	0,000
Passive Learning	119,61	126,55	62,93	46,694	2	0,000
Grades as Feedback	119,91	134,09	54,84	68,796	2	0,000
Laboratory Experiences	165,06	77,64	65,82	116,316	2	0,000

Table 7 shows that the six perceptual factors of scientific learning showed significant differences in each school. This is evidenced by the value of Asymp. The sixth Sig perception factor was 0,000 <0,05.

Furthermore, the research also answered the influence of perception of scientific learning in terms of gender differences. Statistical test results can be seen in Table 8.

Table 8. Non Parametric Statistics Test Results Differences in Perception of Scientific Learning Based on Gender Differences

Gender	N	Mean Rank	Man-Whitney U	Wilcoxon W	Z	Asymp. Sig (2 tailed)
Man	115	103,49	5231	11901	-0,004	0,997
Woman	91	103,52				

Table 8 shows that the perception value of scientific learning in terms of gender showed a significance value of 0.997 which means that the significance value was greater than 0.05 (> 0.05). This means that perception of gender do not show significant differences. The details of six scientific learning perception factors can be seen in Table 9.

Table 9. Test Man-Whitney U Statistics on Perception Factors of Scientific Learning Based on Gender Differences

Factor	Mean Range		Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig (2-tailed)
	Man	*Woman*				
Pedagogical Strategies	99,29	108,82	4748,000	11418,000	-1,141	0,254
Faculty Interest in Teaching	107,7	98,19	4749,500	8935,500	-1,137	0,255
Student Interest and Perceived Competence	104,79	101,87	5084,000	9270,000	-0,350	0,726
Passive Learning	100,25	107,6	4859,000	11529,000	-0,881	0,378
Grades as Feedback	99,93	108,01	4822,000	11492,000	-0,971	0,332
Laboratory Experiences	106,16	100,14	4926,500	9112,500	-0,726	0,468

There was not any significant difference in perception of scientific learning seen from gender. The value of pedagogical strategy (0.254), Faculty interest in teaching (0.255), student interest and perceived competence in scientific learning (0.726), passive learning (0.378), grades as feedback (0.332) and laboratory experience (0.468) greater than significance of 0.05. Based on the findings, it can be concluded that between male and female students have the same perception of scientific learning.

The next research question that was answered was critical thinking skill in terms of school differences. The results of the tests of critical thinking skill were analyzed using non-parametric statistics using the Kruskall Wallis test. Table 10 shows the details of the statistical test results.

Table 10. Non Parametric Statistics Test Results in Criticsl Thinking Skill Based on School Differences

School	N	Mean Rank	Chi-Square	Df	Asymp Sig.
A	70	138,92	38,306	2	0,000
B	69	89,86			
C	67	80,54			

The results of the Kruskal Wallis statistical analysis show a significance value of 0,000 <0,05. The details of each indicator of students' critical thinking skill is provided in Table 11.

Table 11. Test Kruskal Wallis Statistics on Indicator of Critical Thinking Skill based on School Differences

Indicator	Mean Range			Chi-Square	df	Asymp. Sig
	A	*B*	*C*			
Basic Classification	171,50	78,05	58,67	168,432	2	0,000
Basis for a decision making	118,49	104,49	86,82	9,890	2	0,000
Inference	130,56	92,61	86,44	24,600	2	0,000
Advanced classification	42,03	136,17	134,08	113,825	2	0,000
Supposition and integration	132,04	90,45	87,12	26,354	2	0,000

As shown in Table 11, the basic classification, basis for a decision making, inference, advanced classification, supposition and integration show that there were differences in critical thinking skill of each school with a significance value of 0,000 <0,05.

The ability to think critically on gender differences was one of the problems that was examined. Of the three schools that were the subjects of the study, it was found that the number of male students was 115 and women were 91. Table 12 shows the results of statistical analysis of critical thinking skills in terms of gender.

Table 12. Non Parametric Statistics Test Results in Critical Thinking Skill Based on Gender Differences

Gender	N	Mean Rank	Man-Whitney U	Wilcoxon W	Z	Asymp. Sig (2 tailed)
Man	115	101,43	4995,000	11665,000	-0,559	0,576
Woman	91	106,11				

Based on Table 12, it is known that the value of the non-parametric statistical test has a significance result of 0.576 <0.05. This means that critical thinking skill in scientific learning seen from gender do not show significant differences. The detail of the statistical tests translation on critical thinking skill based on gender can be seen in the Table 13.

Table 13. Test Man-Whitney U Statistics on Indicator of Critical Thinking Skill based on Gender Differences

Factor	Mean Range		Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig (2-tailed)
	Man	*Woman*				
Basic Classification	99,87	108.09	4560,500	8746,500	-1,725	0,084
Basis for a decision making	103,57	103,41	4815,000	11485,000	-0,993	0,321
Inference	95,79	113,25	5224,000	9410,000	-0,021	0,983
Advanced classification	95,79	113,25	4345,500	11015,500	-2,097	0,036
Supposition and integration	104,29	102,50	5141,500	9327,500	-0,223	0,824

It was found that there were differences in critical thinking skills in the advanced classification indicators. This is evidenced by the value of Asymp-Sig (2-tailes) on the advanced classification indicator of 0.036 <0.05. Meanwhile, the Man-Whitney test results on basic classification, basis for decision making, inference, suppositions and integration show that there are no differences based on gender. It is proven by the value of Asymp sig (2-tailed) basic classification indicator 0.084> 0.05, basis for a decision making was 0.321> 0.05, inference was 0.983> 0.05, and integration supposition was 0.824> 0.05. It can be concluded that gender differences can affect critical thinking skills based on advanced classification.

3.4 The influence of scientific learning perception towards critical thinking skill on students in scientific learning

The fourth research question is answering the influence of perception on students' critical thinking skill in scientific learning. To answer the question, the data linearity test was first performed. The data of the linearity test results is provided in Table 14.

Table 14. Linearity Test Results of the Influence of Perception Towards Critical Thinking Skill

			Sum of Squares	df	Mean Square	F	Sig.
Critical Thinking Skill*Perception	Between Groups	(Combined)	21262.693	114	186.515	1.169	.220
		Linearity	4570.022	1	4570.022	28.634	.000
		Deviation from Linearity	16692.671	113	147.723	.926	.654
	Within Groups		14523.583	91	159.600		
	Total		35786.277	205			

Significance <0.05

The Deviation from linearity value has a significance of 0.654, which means it is greater than 0.05. The conclusion that can be drawn is that there is a linear relationship between the perception variables and the critical thinking skill variable. Furthermore, after determining the linearity of the data, a simple linear regression analysis test was carried out and can be seen in Table 15.

Table 15. Regression Analysis

Model		R Square	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
			B	*Std. Error*	*Beta*		
1	(Constant)	0.128	21.602	3.790		5.700	0.000
	Perception		0.104	0.019	0.357	5.465	0.000

Dependent variable: Critical Thinking Ability

As shown in Table 15, it was found that the constant number of unstandardized coefficients was 21.602. The number of regression coefficients shows the number 0.104, which means that every addition of 1% perception, the critical thinking skill increased

by 0.104. To see the influence between perception and critical thinking skill, it can be done by comparing the significance values with a probability of 0.05. Based on the Table 15, it is known that the significance value was 0,000 <0,05. This means that perception have a significant influence on students' critical thinking skill. The value of R Square showed a value of 0.128. This means that the influence of student perception of scientific learning has an influence on the ability to think critically in scientific learning at 12.8%. The findings indicate that student perception has a positive influence on critical thinking skill which means that the better students' perception of scientific learning will affect the improvement of students' critical thinking skill.

4 Discussion

This study was conducted to describe and test the influence of scientific learning perception on students' critical thinking skill. The results showed that most of the students' perception in scientific learning was in a medium category (46.12% based on school and 46.12% based on gender). The findings showed that there was not any significant differences between male and female students both in perception of learning and critical thinking skill, but differences were seen in schools. The instrument used refers to six scientific learning factors, namely pedagogic strategy, interest in learning, student interest, passive learning, value of feedback, and laboratory experience by [22]. The selection of PSCS instrument was done by considering the conditions of learning that were clearly reflected in the instruments used [23]. Meanwhile, the selection of indicators of critical thinking skill was adjusted to the conditions of students. In accordance with the characteristics of the students, it should be developed a test of students' critical thinking skill [24, 25].

The obtained research results were different perception and critical thinking skill of scientific learning based on school. The schools studied were schools that have different locations and levels. This would directly inpact on the student learning environment and subsequently on the learning outcomes [26]. Schools would directly interact with people's lives around the location. Public High School A had an average perception and critical thinking skill that are better than Public High School B and C. It is likely that school A had a superior grade and was located in a city that has better access to facilities compared to schools B and C. It is confirmed by [27] who state that the provision of important learning facilities and influence on learning outcomes.

This is also reinforced in the findings of interviews that ask about students' basic knowledge of scientific learning and difficulties during learning. Students in the three schools understood scientific learning as learning that invites them to discover their own knowledge through various field activities and experiments, but students showed difficulties in attending scientific learning especially students of Public High School C. In Public High School A, students showed that they did not have any difficulty in implementing scientific learning, but they still need a lot of improvement in their critical thinking skill. From the results of the interview with Public High School A students, they indicated that they also did not have any difficulty to participate in learning, and they enjoyed active learning. This is in line with previous study by [28]

showing that students in scientific learning put more emphasis on active, communicative, and collaborative activities. However, high and medium students of Public High School A in critical thinking skill indicated that they had difficulty distinguishing valid and invalid information.

The research results on student perceptions and critical thinking skills in scientific learning based on gender differences showed that there was not any difference between male and female students in perceptions and critical thinking skill. This is supported by [29] who state that the perceptions and attitudes of students in scientific learning showing no differences between male and female students. This result is also supported by a study from [30] which states that female students appear comparable to male students in science classes on physics subject. This equation can be seen from the motivation to learn science and learning satisfaction. However, the result of this study is in contrast from the research results by [23] which reveal that female students have more positive perceptions than male students in scientific learning. [28] research results show that there are differences in critical thinking skill that differ from gender, that male students outperform female students in analyzing problems. The results of the study showed students' low critical thinking skill in geography subject was seen in students' difficulties in their ability to make decisions, conclusions, and advanced classifications which were in the fairly critical category. In abilities that fall into the fairly critical category, students are only able to answer problems through data and facts that are read [31]. This low critical thinking skill is suspected because students were not accustomed to carrying out learning activities outside the classroom. Outside classroom learning is intended so that students can conduct data and fact investigations [32]. The process of investigation in the field is very important, so that students are skilled and not confused when faced environmental problems [33].

Low critical thinking skill was also found in the characteristics of student answers to the environmental problems presented. The answers given looked similar and incomplete. This characterized that students' ability to think is still in the basic level. In basic level thinking, students were only able to answer questions in a straightforward manner, but when the question was continued to more specific questions (such as how the data and facts are valid or are there other findings obtained in the field), the students became confused. This was due to the lack of students' involvement in each learning activity. Students are accustomed to accept an explanation without asking for the truth [6, 34]. In geography learning, it is very important to involve students in each activity both preparation and evaluation [35,36]. When students are actively involved in learning, students feel that they are important and easy in the learning process.

The lowest score for indicators of critical thinking skill was in supposition and integration. This supposition and integration were the ability of students to discuss the right reasons and revise thoughts [16]. The low indicator of critical thinking skill in supposition and integration was caused by students who seemed lack focus when geography learning takes place. Students were confused when faced with problems they had just acquired. This was because when geography learning activities take place, students got less guidance on how to get new knowledge from connecting phe-

nomena with concepts that have been obtained by students [1]. Geography learning should be able to find concepts and apply them in daily life [35, 37].

Another finding obtained from this study is that there was an influence of perceptions towards critical thinking skill. The findings showed that the influence of perception on critical thinking skill was 12.8%. This can be interpreted that the more positive students 'perceptions of scientific learning will improve students' critical thinking skill to be better. The importance of critical thinking skill can be seen from student responses during critical thinking learning activities. Through good perception, all of the senses will move positive stimuli to help students learn well [37]. Other researchers also stated that the first thing to do is to create positive thoughts about the activities that will be carried out in order to obtain good learning outcomes. In the research carried out, learning abilities can be improved through giving treatment in learning to help students succeed in learning [38].

Several previous studies explained that the ability to think critically in geography subject can be improved in several ways. Studies from [35] state that in order to be able to teach students' critical thinking in geography learning, students are required to be active in learning activities. Students must be able to provide simple and real examples of the concepts newly discovered by students during learning. Furthermore, a study from [1] states that critical thinking skill can be improved through the provision of worksheets for students so that each geography learning activity can be well organized. Furthermore, a study from [33] reveals that learning in the field of geography is important for building concepts and teaching students' critical thinking. Based on research conducted and previous findings, it is necessary to attempt to improve the quality of students' critical thinking skill through supporting components of learning activities.

Some previous research findings also mention that critical thinking skill in other subjects are also still low. Therefore, it needs solutions to improve critical thinking skill through modifying new ways of learning. Efforts of improvement can be done through creating a supportive classroom environment [5,39], applying learning models [40,8,3], involving students in learning activities [41,42], discussion and investigation activities [43], development of evaluation tools [44], improving pedagogical abilities of teachers [44,45], and involving students in conducting demonstrations and reflective activities [13].

Based on results of this study, the findings revealed an increase in students 'perceptions of scientific learning, then it would directly improve students' critical thinking skill. Based on the results and supported by findings of previous researchers, efforts are needed to improve students' perceptions of learning. The efforts made are creating innovative learning methods, increasing student activity in learning activities, and providing learning facilities that support students' scientific activities.

5 Conclusions and Implications

Students' perceptions in scientific learning are mostly on medium perceptions. However, students' critical thinking skill in scientific learning is still in the low cate-

gory. The low ability of thinking took place from the activities of providing basic clarification, making basic decisions, conclusions, advanced classifications, suppositions and integration. This shows the importance of an effort to improve students' critical thinking skill so that scientific learning can achieve the expected final results. The results of this study did not show differences of perceptions towards scientific learning and critical thinking skill in scientific learning based gender, but they have differences in different schools. The results of the study also show that student perceptions have an influence on critical thinking skill. Therefore, to improve critical thinking skill, efforts must also be made to improve students' positive perceptions through the use of innovative learning models, involving students in learning activities, improving pedagogical abilities of teachers and improving laboratory experience and classroom activities.

6 Acknowledgement

The author are grateful to Lembaga Pengelola Dana Pendidikan (LPDP) Indonesia for giving them the opportunity to conduct doctoral studies through the Beasiswa Unggulan Dosen Indonesia Dalam Negeri (BUDI-DN). The author also wants to give a thanks to the Department Geography, Faculty of Social Sciences, Universitas Negeri Malang that provide many opportunities to learn.

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Article submitted 2019-06-01. Resubmitted 2019-07-12. Final acceptance 2019-07-12. Final version published as submitted by the authors.