

## ANALYSIS OF STUDENTS CRITICAL THINKING ABILITY BASED ON GENDER IN SCIENCE LEARNING ENVIRONMENTAL POLLUTION TOPICS

Siska Oktafiana Dewi and Erman\*

Department of Science Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya,  
Indonesia

\*Email: [erman@unesa.ac.id](mailto:erman@unesa.ac.id)

Received: June 3, 2022. Accepted: July 24, 2022. Published: July 31, 2022

---

**Abstract:** This study aims to describe the differences in the critical thinking ability of male and female students at junior high school (SMPN 27 Surabaya) on environmental pollution topics. The type of research used is descriptive. The research sample was 34 students of SMPN 27 Surabaya class VII F consisting of 17 female students and 17 male students. Data collection was carried out using critical thinking skills tests, student questionnaires, and learning observation sheets. The data obtained include students' critical thinking skills, observation results, and interview results that have been grouped based on the student's gender. The results of this study show that there are differences in critical thinking skills between male students and female students. Female students scored an average critical thinking ability of 75, while male students scored 65. The critical thinking ability of female students is higher than that of male students, as evidenced by the average score of female students being higher than that of male students. It shows that in learning activities, teachers must pay attention to student gender differences, motivate students, and choose the appropriate learning model.

**Keywords:** *Critical Thinking, Gender, Environmental Pollution.*

---

### INTRODUCTION

The development of technology and science that is increasingly advanced requires aspects of education to continue to develop to produce quality human resources that can face the 21st-century era. One of the abilities required to be possessed by all humans is the ability to think critically. Critical thinking is generally considered a characteristic of the individual and is part of cognitive development [1]. The ability to think critically is the ability to think through a process of analysis and meticulousness in responding to the truth of the information in the hope that it will give rise to correct action. The ability to think critically is important to have because the ability to think critically can be applied as a way of solving a problem as well as making decisions based on logical reasons [2].

The ability to think in learning activities can be trained through science learning [3]. Student learning activities in science learning require students to have the ability to think critically so that students are ready for technological developments that are increasingly advanced and developing [4]. Indicators used to determine the activity of students' critical thinking ability in solving a problem can use five indicators, namely (a) providing simple explanations, (b) building basic skills, (c) concluding, (d) providing further explanations, (e) building strategies and tactics [5].

Science learning has an essential role in developing critical skills [6]. The material in science learning that is closely related to critical thinking skills is environmental pollution material. Students' critical thinking skills can be improved by conditioning the learning process without using much rote memorization, but students are given

problems to improve their thinking skills [7]. Environmental pollution material discusses analyzing the causes and effects of pollution problems that occur in an environment. Environmental pollution material is closely related to aspects of science, society, and the environment, as well as technology that is currently happening. Environmental pollution material requires students to analyze, be active, and understand the learning material. Students learn to identify the source of problems that occur around them so that it will help students come up with problem-solving ideas and build their critical thinking skills from students.

The difference in critical thinking skills makes each student have different abilities. Students will use a variety of strategies and various ways to solve a problem that arises in the problem. This difference is because students tend to have different intellectual abilities that affect their critical thinking.

Gender influences students' critical thinking ability. Gender is one of the things that influence critical thinking skills [8]. Gender is a difference in roles, piker patterns, behavior, mentality, and emotional characteristics between men and women [9]. Women, in general, are better at remembering, while men are better at thinking logically and making decisions. The phenomenon of differences in critical thinking ability between men and women can be seen in previous research conducted by Budi Cahyono, showing results that female students can show all indicators of their critical thinking ability compared to male students [10]. Female students are better at using their critical thinking skills than male students [11]. Seyed and Akbar's research on the relationship between gender and critical thinking showed significant differences between the critical thinking

ability of male and female students [12]. Female students give higher results on their critical thinking abilities than male students [13].

The interview results with the science teacher at SMPN 27 Surabaya said that in the science learning process, student involvement was not fully optimal, especially when the teacher allowed students to ask questions and answer questions from the teacher were still many students who were just silent. One of the signs that students can think critically in learning is when students actively answer and provide questions following learning. The observations at SMPN 27 Surabaya on students during learning showed that eight female students could meet critical thinking indicators. Of the male students who successfully showed their critical thinking skills in the class, only five students. It is also supported by an interview with a teacher of science subjects at SMPN 27 Surabaya, who said that when the teacher gave questions to provoke students' critical thinking, different responses were obtained between male and female students. The results of interviews with teachers of science subjects also stated that the critical thinking ability between female students and male students had never been measured before.

Based on observations that researchers at SMP Negeri 27 Surabaya have made, it is necessary to conduct further research to analyze the differences in critical thinking ability in male and female students at SMP Negeri 27 Surabaya on environmental pollution material. This research is different from the previous relevant research, reviewed from the research place, the study's subject, and the research instrument. This research is expected to provide an overview to science teachers to find out a picture of the critical thinking ability of male and female students at SMPN 27 Surabaya, applying suitable learning models and methods so that students think more critically.

## RESEARCH METHODS

This research includes descriptive research by analyzing students' critical thinking ability based on the gender of environmental pollution material that can be measured by providing test questions for students' critical thinking ability. This research was carried out on 34 students consisting of 17 male students and 17 female students. The class has the same comparison of female and male students and has obtained environmental pollution materials.

### Procedure

Data collection in this study was carried out using tests, observations, interviews, and documentation to determine students' critical thinking abilities on environmental pollution material. In the pre-field stage, interviews were conducted with science teachers at school. The next stage is the research stage. This stage is carried out to observe the implementation of learning activities in the classroom using an implementation observation

sheet. This observation sheet is carried out through observation when the teacher learns environmental pollution material in class. Students are then given a critical thinking ability test question on environmental pollution material. The next stage is to conduct interviews with students and teachers using unstructured interviews related to students' critical thinking skills at school.

### Instruments

This study used tests of critical thinking skills, observation, and questionnaires. The critical thinking ability test is used to measure students' critical thinking ability, which will later be known as how gender affects students' critical thinking ability. The critical thinking ability test questions are 20 questions that have been prepared in accordance with 5 critical thinking indicators. According to Ennis, each indicator has 4 questions. Observation instrument sheets are used in research to determine the implementation of students' critical thinking skills in learning activities. Questionnaires are given to students to find out students responses regarding their critical thinking skills during learning. Observation of the implementation of learning is seen when students do questions from the teacher.

### Data Analysis

The test results regarding students' critical thinking ability are grouped based on gender, namely men and women. The results of the critical thinking ability test from the study were then interpreted based on the category of critical thinking ability based on table 1 [14].

Table 1. Categories of critical thinking ability

Score	Critical Thinking Ability Category
81 – 100	Very Good
61- 80	Quite Good
41- 60	Good
21- 40	Less Good
0 - 20	Not Good

Students' critical thinking ability scores are presented in the form of percentages to determine the level of students' critical thinking ability on each indicator. The formula for processing the score into a percentage form is as follows:

$$\frac{\text{Number of student scores of each indicator}}{\text{Number of Maximum values of each indicator}} \times 100\%$$

Furthermore, the analysis is carried out on the implementation of learning activities that the teacher has carried out in training students' critical thinking skills. The formula used is as follows:

$$\frac{\text{The number of sub-indicators is met}}{\text{Sum of all sub-indicators}} \times 100\%$$

Further data analysis was carried out on teachers' learning implementation plan in environmental pollution material. This learning implementation plan analysis is carried out to determine the learning methods carried out by the teacher and the learning steps carried out by the teacher to bring out students' critical thinking skills. Then the analysis was carried out on a questionnaire of student responses and the results of interviews that had been carried out with teachers and students as research supporting data.

**RESULTS AND DISCUSSION**

The test results of students' critical thinking ability on environmental pollution materials are grouped based on gender, namely male and female students. The test results are then scored according to their critical thinking skills in answering questions and then categorized into 5 categories. The test result scores are then analyzed and categorized accordingly in table 2.

Table 2. Students' thinking ability based on gender

No.	Score	Female	Male	Category
1.	81-100	3	1	Very Good
2.	61-80	14	9	Quite Good
3.	41-60	0	6	Good
4.	21-40	0	1	Less Good
5.	0-20	0	0	Not Good
Average		75	65	
Category		Quite Good	Quite Good	
		Good	Good	

Table 2 shows that the same ratio of the number of students between male and female students, the achievement of the highest average thinking ability score was owned by female students with an average score of 75, which was included in the quite good category. The average score of students' critical thinking ability men was lower than female students by 65, belonging to the quite good category.

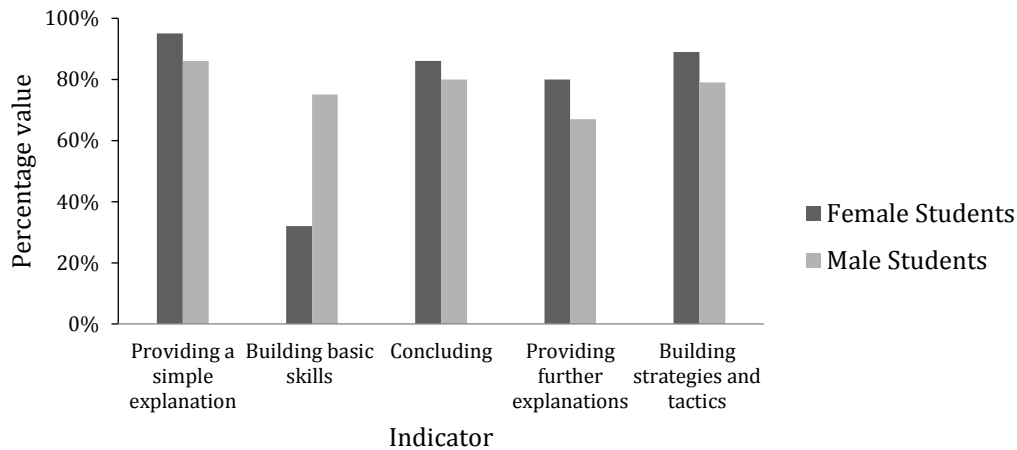


Figure 1. Analysis of students' critical thinking skills per indicator

Figure 1 shows that the results of the critical thinking ability of male and female students on each indicator have different values. The indicators provide a simple explanation female students and male students have the highest percentage scores of all indicators. The lowest critical thinking indicator in female students lies in building basic skills, while in male students in the indicator of making further explanations. The largest difference in the percentage of critical thinking ability between male and female students lies in the basic skills building indicator, which is 43%.

This analysis of the implementation of learning is carried out when the teacher asks students about learning materials. Teachers, in provoking students' critical thinking skills, give students as many as ten questions that critical thinking indicators have prepared. Analysis of the implementation of learning that stimulates students' critical thinking ability in learning environmental pollution in each indicator is known that: the highest implementation of the

indicator provides a simple explanation, namely 100% of the implementation, followed by the indicator of building strategies and tactics by 60%, concluding 40%, then making further explanations with a percentage of implementation of 25%, and the last one is building basic skills by the percentage of implementation by 20%.

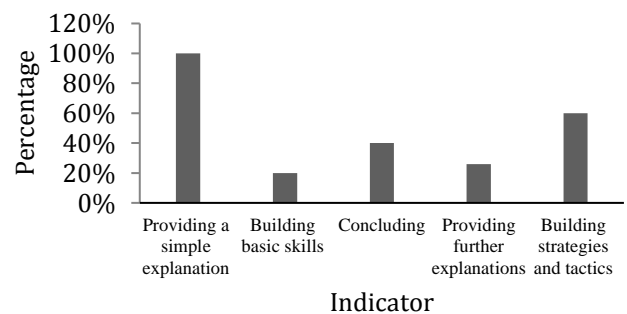


Figure 2. Analysis of the implementation of learning stimulates critical thinking of each indicator

The results of the student response are given to the students after the students have finished working on the test questions and contain how the students respond to the student's critical thinking skills on environmental pollution material. Analysis of student response questionnaire results showed that 89% of students positively responded to the ability to think critically about environmental pollution materials. Based on the response questionnaire provided by students, the average student strongly agrees with the ability to think critically about environmental pollution material.

Analysis of students' critical thinking ability on environmental pollution learning based on table 1 shows that the critical thinking ability of female students is higher than that of male students. The readiness factor of the student can influence the difference in achievement. The results of the interviews that have been carried out with the student show that female students are superior in communication and more motivated and organized in their learning than male students. In addition, this can happen because women are superior in their effective aspects. It follows the question from Krutetski, who said that women are more likely to have the ability to accuracy, thoroughness, and equality of thinking [15]. It is supported by the results of interviews with students who state that female student are more able to identify problems and phenomena in the questions more precisely and in detail. It can be known when in interviews female students can retell the phenomena contained in the problem of using their own words and can relate to the concepts obtained during learning. This data is also supported by the teacher's statement that female students are skilled in showing their critical thinking skills. It is seen when the teacher gives questions that contain indicators of critical thinking of female students who show a positive response. The critical thinking ability of female students is higher than that of male students [16]. This result is also supported by Na Li's research, which showed that female students had higher scores in their critical thinking ability than male students [17].

Analysis of students' critical thinking skills in each indicator is found in Figure 1. The ability to think critically on each indicator in this study showed that male students obtained the highest critical thinking ability on the indicator of providing a simple explanation, which was 86%. It is also the case for female students. The highest indicator of critical thinking ability lies in providing simple explanations, with a percentage of 95%. It shows that almost all students can provide simple explanations regarding what is asked in the questions. It is also supported by student interviews and learning observations, which show that most students can identify problems in the questions and retell the information in the environmental pollution questions. This statement corresponds to the statement by Resky that both male and female students can show

indicators of critical thinking by giving simple explanations.

Male students' lowest critical thinking ability is found in the indicator of making further explanations, which is 67%. Meanwhile, the results of the critical thinking ability of female students are the lowest in the indicator of building basic skills, which is 32%. It follows the results of interviews conducted on male students, which stated that male students could not relate the problem to the concept. They are less able to express factual and precise reasons related to the solution of the phenomenon that occurs in the problem. Most female students have been unable to show their ability to do the right analysis to solve the problem. This statement is supported by the results of interviews conducted by teaching teachers who stated that male students provide more detailed explanations and only brief explanations. Students still feel they need to improve their abilities in providing further explanations, while female students are less skilled in analyzing to get answers to questions. Male and female students did not score high in the analyticity dimension [17]. Females are less adept at finding the cause of neglect, logical analysis, and reason and pay less attention to logic and reason. This statement follows research conducted by Sukriadi states that female students are less able to analyze questions and statements appropriately, so in terms of critical thinking indicators and building basic skills, female students are still considered low [18]. In addition, research conducted by Wardani showed low scores on basic skills-building indicators and provided further explanations [8].

Figure 2 indicates that the implementation of learning on environmental pollution topics shows that the indicator provides a simple explanation that it has been carried out 100%. The results of student test scores show that the highest percentage of scores on the indicators provides a simple explanation where most students in the class can already do simple explanations as expected by the teacher. At the same time, the lowest percentage of value is in the indicator of building basic skills at 20%. It also corresponds to the results of the student's critical thinking ability test scores in Figure 1, which show the lowest average score lies in the basic skills building indicator. Male and female students are still underprivileged in analyzing and identifying arguments in depth. However, male students and female students have differences. Male students are superior in their ability to build basic skills than male students. This is because they have not been able to connect the concepts of learning materials independently to solve the problem. At the same time, female students are not yet right to provide analysis of the questions given. This is in line with Krutetskii's research which states that male students are superior in the aspect of analytical thought processes [15]. It is also supported by the findings in the field that the level of achievement in learning on

the indicators of building basic skills has the lowest value. The results of the interview with the teacher stated that this could happen because students are poorly trained to analyze the phenomena contained in the questions, so students are less trained in terms of analysis.

Science teachers at SMP Negeri 27 Surabaya feel that critical thinking skills need to be trained and raised so that students can develop their thinking. The analysis of the learning implementation plan used by teachers in the learning process showed that teachers use the PBL (Problem Based Learning) learning model. This learning model can stimulate students because this learning model uses real problems that exist in everyday life so that students can know the phenomenon in real terms and make students easily connect concepts with critical thinking skills because students are required to be actively involved in learning. The Problem Based Learning model allows students to try to solve problems based on the knowledge they already have before and connect the previous material with the new material learned [19]. Research conducted by Hussin states that the PBL learning model effectively develops students' critical thinking skills [20]. The PBL learning model can improve critical thinking skills [21]. In addition to using learning models, teachers also use a scientific approach. In the learning process, the teacher shows a real phenomenon that occurs around the student at the beginning of the learning. Then, the student can respond to the phenomenon by responding. This statement follows research conducted by Nur Wakhidah which states that a scientific approach can stimulate students' critical thinking skills [22].

## CONCLUSION

Students' critical thinking ability on environmental pollution topics differs between male and female students. The results showed that female students had higher critical thinking skills on environmental pollution materials than male students. The critical thinking ability of female students lies the highest in the indicator of providing a further explanation. In contrast, the lowest critical thinking ability lies in building basic skills. The highest critical thinking ability of male students lies in the indicator of giving a simple explanation and the lowest in the indicator of making further explanations.

## ACKNOWLEDGEMENTS

This research can be carried out well due to the help of various parties. In this opportunity, the researcher would like to express his gratitude to:

1. Prof. Dr. Erman, M.Pd., as the supervisor
2. or. Mrs. Tutut Nurita, S.Pd., M.Pd. and Mrs. Dhita Ayu Permata Sari, S.Pd., M.Pd. as content validators.
3. Mrs. Novie Endah Sulistyowati, S.Pd., Mr. Rafi'an Hidayat, S.Pd. and Mr. Mohammad Reza

Fahlafi, S.Pd as science teachers of SMP Negeri 27 Surabaya.

4. Class VIIF SMP Negeri 27 Surabaya students have helped researchers carry out research.

## REFERENCES

- [1] Morris, L. V. (2017). Moving beyond critical thinking to critical dialogue. *Innovative Higher Education*, 42(5), 377-378.
- [2] Nussbaum, M., Barahona, C., Rodriguez, F., Guentulle, V., Lopez, F., Vazquez-Uscanga, E., & Cabezas, V. (2021). Taking critical thinking, creativity and grit online. *Educational Technology Research and Development*, 69(1), 201-206.
- [3] Ramandha, M. E. P., Andayani, Y., & Hadisaputra, S. (2018, October). An analysis of critical thinking skills among students studying chemistry using guided inquiry models. In *AIP Conference Proceedings* (Vol. 2021, No. 1, p. 080007). AIP Publishing LLC.
- [4] Agnafia, D. N. (2019). Analisis kemampuan berpikir kritis siswa dalam pembelajaran biologi. *Florea: Jurnal Biologi dan Pembelajarannya*, 6(1), 45-53.
- [5] Ennis, R. 1996. Critical Thinking Dispositions: Their Nature and Assessability. *Informal Log*, 18(2), 165-182.
- [6] Jamaluddin, J., Jufri, A. W., Muhlis, M., & Bachtar, I. (2020). Pengembangan Instrumen Keterampilan Berpikir Kritis Pada Pembelajaran IPA di SMP. *Jurnal Pijar Mipa*, 15(1), 13-19.
- [7] Aini, Z., Ramdani, A and Raksun, A. (2018). Perbedaan Penguasaan Konsep Biologi Dan Kemampuan Berpikir Kritis Siswa Kelas X Pada Penerapan Model Pembelajaran Kooperatif Tipe Group Investigation Dan Guided Inquiry Di Man 1 Praya. *Jurnal Pijar Mipa*, 13(1), 19-23.
- [8] Wardani, W., Astiana, I. K., & Susilo, S. (2018). Pengaruh Gender terhadap Kemampuan Berpikir Kritis Siswa SMA Program IPS pada Mata Pelajaran Geografi. *Jurnal Pendidikan*, 3(12), 1530-1534.
- [9] Fibrianto, A. S. (2016). Kesetaraan Gender Dalam Lingkup Organisasi Mahasiswa Universitas Sebelas Maret Surakarta Tahun 2016. *Jurnal Analisa Sosiologi*, 5(1), 10-27.
- [10] Cahyono, B. (2017). Analisis Keterampilan Berpikir Kritis dalam Memecahkan Masalah Ditinjau Perbedaan Gender. *Aksioma*, 8(1), 50-64.
- [11] Hidayanti, R., Alimuddin, & Syahri, A. A. (2020). Analisis Kemampuan Berpikir Kritis Dalam Memecahkan Masalah Matematika Ditinjau Dari Perbedaan Gender Pada Siswa Kelas VIII SMP Negeri 2 Labakkang. *Jurnal SIGMA (Suara Intelektual Gaya Matematika)*, 12(1), 71-80.
- [12] Afshahi, S. E., & Afghari, A. (2017). The

- Relationship between Mother Toungue, Age, Gender and Critical Thinking Level. *Journal of Applied Linguistics and Language Research*, 4(1), 116-124.
- [13] Ardito, G., Czerkawski, B., & Scollins, L. (2020). Learning Computational Thinking Together: Effects of Gender Differences in Collaborative Middle School Robotics Program. *TechTrens*, 64(3), 373-387.
- [14] Rahmawati, S., Masykuri, M., & Sarwanto. (2019). Analisis Kemampuan Berpikir Kritis Topik Klasifikasi Materi dan Perubahannya Siswa SMP Negeri di Kabupaten Magetan. *Semin. Nas. Pendidik. Sains*, pp. 173–178, 2019.
- [15] Krutetskii, V. A. (1976). *The Psychology of Mathematical Abilities in School Children*. Chicago, IL: University of Chicago Press.
- [16] Yanti, E. D., Wigati, I., & Habisukan, U. H. (2019). Perbedaan Kemampuan Berpikir Kritis Laki-laki dan Perempuan pada Materi Sistem Peredaran Darah Mata Pelajaran Biologi Kelas XI MIPA MAN Banyuasin III. *Bioilmi*, 5(1), 66-71.
- [17] Li, N. (2022). Reasonable or Unwarranted? Benevolent Gender Prejudice in Education in China. *Asia Pacific Edu Res*, 31(2), 155-163..
- [18] Sukriadi, S., & Kurniawan, K. (2019). Profil Penalaran Siswa Smp Dalam Pemecahan Masalah Matematika Timss Ditinjau Dari Perbedaan Gender. *JPMI (Jurnal Pendidikan Matematika Indonesia)*, 4(1), 36-41.
- [19] Wulandari, N. I., Wijayanti, A., & Budhi, W. (2018). Efektivitas model pembelajaran problem based learning terhadap hasil belajar ipa ditinjau dari kemampuan berkomunikasi siswa. *Jurnal Pijar MIPA*, 13(1), 51-55..
- [20] Hussin, W. N., Harun, J., & Shukor, N. A. (2019). Problem Based Learning to Enhance Students Critical Thinking Skill Via Online Tools. *Asian Social Science*, 15(1), 14-23.
- [21] Satwika, Y. W., Laksmiwati, H., & Khoirunnisa, R. N. (2018). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan*, 3(1), 7-12.
- [22] Wakhidah, N. 2018. Pembelajaran dengan Pendekatan Saintifik terhadap Kemampuan Berpikir Kritis Mahasiswa Calon Guru Madrasah Ibtidaiyah. *Jurnal Pendidikan Dasar dan Pembelajaran*, 8(1), 150-160.