

An Analysis of Elementary School Prospective Teachers' Critical Thinking: A Gender Perspective

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Abstract: This study aims at analyzing the elementary school prospective teachers' critical thinking viewed from the gender aspect. The method employed was a quantitative study with a descriptive approach. Conducted at Elementary School Teacher Education Department, this study involved 25 male students and 25 female students as participants. Data collection was done by means of a test about environmental pollution material. Facione's theory, comprising interpretation, evaluation, analysis, inference, and self-regulation, was used to analyze critical thinking. To analyze the data, descriptive quantitative analysis was employed. The findings shows that female elementary school prospective teacher students have better critical thinking skills than male students. It is shown by the higher average of every indicator in females with 3.1 in the good category, while the males' average is 2.46 in the fair category. The lecturers have to take gender into account in facilitating critical thinking skills by implementing supportive learning methods, facilitating students' learning styles, and providing challenging questions.

Keywords: Critical Thinking, Prospective Teachers, Gender, Elementary School

1. Introduction

Currently, almost all countries want to be more democratic, advanced, and successful in global competition. Equipping a generation with the necessary skills for the 21st century is a great challenge. In this case, the necessary skill in the 21st century learning and teaching imperative for prospective elementary school teachers is critical thinking (Kuloğlu, 2022). Critical thinking analysis is one method for developing and honing high-level thinking in one's mind as a result of his desire to assess, analyze, and evaluate a problem. Not everyone has critical thinking skills, as suggested by Facione (2007), but when someone has good critical thinking, that person has a high curiosity about something, good reasoning, an open mind, is honest to admit mistakes, and when making judgments tends to be careful so as not to make mistakes in solving problems, able to conclude, able to properly analyze future possibilities, and able to make decisions. An individual must have critical thinking skills for their positive and significant impacts. Moreover, language or media will make a positive contribution to prospective elementary school teachers in improving their critical thinking skills.

Studies on thinking skills based on gender differences have been conducted by several researchers, including the study on the effect of gender orientation on critical behavior. The study reveals that gender-based differences in skills are only found in certain areas. Female students require more time and practice than male students, resulting in higher critical thinking skills (Marni., 2020). According to Alfonso (2015), critical thinking skills enable prospective elementary school teachers to improve their understanding of arguments, express their perspectives, and provide important considerations in a topic problem. Summing up several experts, it can be concluded that students who have excellent critical thinking skills will be able to assess the problem from the questions given, supported by logical arguments and evidence (Kazmi, 2017).

Critical thinking is one of the skills that individuals learn in their lives. One of the purposes of critical thinking is to shape students' critical attitudes by providing information, challenges, checking errors, and evaluating mistakes (Oğuz & Sariçam, 2015). According to Halpern (2003), critical thinking is the application of cognitive and strategy which improve the goals set and directed, including problem-solving, conclusion formulating, calculating possibility, and conclusion drawing. A critical thinker should use this skill properly, without guidance, and be aware of any situation (Bayram et al., 2019). Elder and Paul (2012) define critical thinking as the intellectual discipline of information gathered from observation, experience, and reflection and an active process of consideration, implementation, analysis, synthesis, and/or evaluation. Heijltjes et al., (2014) reveals the study conducted at the undergraduate program of International Islamic University Malaysia (IIUM) which suggests that different academic abilities influence different critical thinking. Furthermore, the study justifies that reading ability influences critical thinking skills. Therefore, to improve critical thinking skills, students must practice reading, supported by writing and speaking. Additionally, education is instrumental in improving human resource. The needs of updated education must be considered by the teachers to improve the human resource. It reflects the critical thinking concept as taught by Greek philosophers like Socrates, Plato, and Aristoteles (Mercy., 2020)

Students need critical learning skills in learning, one of them is for learning science because scientific knowledge provides facts, concepts, and principles, and it helps students to explore natural discovery. The nature of science learning is that science studies symptoms through a systematic procedure renowned as scientific attitude-based science processes, and the results are realized in the form of scientific products composed of the three main components under the form of concepts and principles exist, and theories which apply universally. Students gain benefits from studying science in elementary school through learning about both themselves and the natural world. Therefore, science learning is one of the most important topics, and existing problems should be addressed. If the issue is not fixed right away, it might be found that student learning outcomes are also inadequate (Wahyu et al., 2019).

In this study, the material used to analyze students' critical thinking skills was about environmental pollution. Environmental pollution material discusses the causes and consequences of environmental pollution, and students are required to find solutions related to this. This material is closely related to everyday life. Science, defined differently, is considered the discipline that seeks to understand, discover, and explain the events that occur in the physical and biological environment (Zorlu, 2020). Humans' demand for natural resources, mindless consumption, and indifference toward the environment also contribute to the gradual increase in environmental pollution. Studies have shown that the main cause of environmental pollution is the human factor. Environmental challenges still require many solutions involving various groups, including universities. Effective teaching in environmental education can influence students' awareness and skill in environmental science courses (Pakpahan, 2022).

Critical thinking skills can be developed through learning materials related to everyday life (Daniati, 2018). Students explore a variety of strategy as they solve problems. Problem-solving strategies can be influenced by gender, which also greatly influences critical thinking processes.

1.1. Problem Statement

Critical thinking skill becomes the key issue in this study because it is a crucial skill that students must have in the 21st century. However, in the learning process, a teacher sometimes neglects the existence of factors that either support or hinder critical thinking itself, one of which is gender. Gender factors need to be investigated in developing students' critical thinking skills, otherwise the teacher will overlook and disregard factors that influence students' critical thinking skills. This study investigates students' critical thinking skills when viewed from the gender perspective.

1.2. Related Research

There are some relevant studies about critical thinking which compare male and female subjects. Meanwhile, some other studies highlight the comparison of males' critical thinking abilities, which are thought to be higher than those of the females' (Mashami et al., 2020). Gender has a positive influence on critical thinking skills (Shubina, I., & Kulakli, 2019) However, other studies present that the critical thinking abilities of male and female students do not vary significantly (Egmir, E., & Ocak, 2020; Kuloğlu, 2022; Marni, S., Aliman, M., & Harsiati, 2020; Mitrevski, B., & Zajkov, 2012; Zetriuslita, H. J., Ariawan, R., & Nufus, 2016). This study examines the critical thinking skills of prospective elementary school teachers from a gender perspective, in order to determine whether male or female students are superior in their critical thinking skills, so that they can be used as a reference for becoming an elementary school teacher. Contributions to education if elementary school teacher candidates have critical thinking skills include helping to increase students' enthusiasm for learning, overcoming problems that arise during the learning process, assisting students in becoming accustomed to thinking critically in order to achieve the learning goals optimally, and providing students with more in-depth knowledge. Additionally, a teacher with critical thinking skills pays attention to factors that can influence students' critical thinking during the learning process.

1.3. Research Objectives

This study aims to analyze the critical thinking skills of male and female students using environmental pollution material. This study implies that students have the knowledge and interest in analyzing the truth using their critical thinking. One of the roles of universities is to promote knowledge development, they must be able to foster critical thinking skills which are important to analyze, particularly from gender perspective to adjust learning and make it more effective.

2. Theoretical Framework

2.1. Definition of Critical Thinking

Rapid changes require people to be well prepared, one of which is by having critical thinking skills (Ariani, 2020; Fikriyatii, 2022; Zain, A. R., 2018). These skills are important, they enable people to take on the obstacles and changes of the industrial revolution 4.0 (Hafni, R. N., Herman, T., Nurlaelah, E., & Mustikasari, 2020; Ridho, S., Wardani, S., & Saptono, 2021; Ulger, 2018). Critical thinking skills in education make a top priority for achieving predetermined learning objectives (Diani, R., Irwandani, I., Al-Hijrah, A.-H., Yetri, Y., Fujiani, D., Hartati, N. S., & Umam, 2019; Gunawan, G., Harjono, A., Muhesti, 2019; Muhammadiyeva, H., Mahkamova, D., Valiyeva, S., & Tojiboyev, 2020). Developments in the 21st century have an impact on learning critical thinking skills. This must be implemented in learning so that students have the necessary resources and skills for the 21st century.

According to Dewey, critical thinking is the active, perseverant, and careful consideration of a concept or knowledge form based on a supporting reason and further conclusion. (Dewey, 1910; Dewey, 1933). Shao et al., (2022) state that critical thinking has two important notions: (1) the results of critical thinking: good intentions, and good deeds; (2) the process of critical thinking: reflection and evaluation in which cognitive skills are applied and critical thinking attitudes are expressed. Norris and Ennis (1989) propose that critical thinking is reflective and rational, and focuses on selecting beliefs and actions. Moreover, critical thinking is known as the metacognitive process that covers some skills: analyzing, evaluating, and concluding. This type of thinking is used to create logic, present opinions, and solve problem (Dwyer, C., Hogan, M., & Stewart, 2014). Tafazzoli (2015) explains that critical thinking is knowing one's place and habits that influence professional decision-making and problem-solving.

Critical thinking skills entail the ability to do information analysis and evaluation (Maknun, 2020; Spector, J. M., & Ma, 2019). Students with critical thinking skills are better in comprehending and analyzing problems in efforts to accomplish their learning objectives (Darmaji et al., 2020). Critical thinking skills can also be used to assess the occurrence of reading misunderstandings. Teachers will have difficulty developing critical thinking abilities in their students if they do not

understand critical thinking and how to develop it in the classroom (Jatmiko et al., 2018; Leasa, et al., 2020; Putri, F. S., & Istiyono, 2017).

Nevertheless, critical thinking is often neglected in Indonesia, especially in education (Ali, G., & Awan, 2021). Teaching critical thinking to prospective teachers has attracted the attention of many researchers. This is due to the fact that teachers play a key role in developing critical thinking skills in educational activities, particularly in teaching and learning activities (Prayogi, S., Yuanita, L., 2018). Critical thinking includes self-management, self-regulation, self-monitoring, and self-correction (Heft, I. E. and Scharff, 2017). Moreover, critical thinking is a tendency or habit of thinking that makes individuals motivated to respond reflectively (Facione, 2015).

A number of findings of prior studies regarding the analysis of critical thinking skills were compared involving male and female subjects. The studies highlight that males' critical thinking abilities are higher than those of females' (Mashami et al., 2020). This implies that gender has a positive influence on critical thinking skills (Shubina, I., & Kulakli, 2019). However, other studies say that there is no discernible difference between male and female students' capacities for critical thinking (Egmir, E., & Ocak, 2020; Kuloğlu, 2022; Marni et al., 2020; Mitrevski, B., & Zajkov, 2012; Zetriuslita et al., 2016).

Based on the aforementioned explanation, it can be concluded that critical thinking is a high-level thinking skill possessed by students to analyze the knowledge gained and integrate it with their daily lives. Tasks that can be carried out by generating ideas or generating solutions to issues in a relevant and logical manner take a long time and must be habituated. In this study, critical thinking refers to the abilities and features of critical thinking of college students who are in the formal operational period, allowing them to think abstractly by manipulating ideas in their minds.

2.2. The Benefits of Critical Thinking

The benefits of critical thinking are as follows: 1) being able to solve problems, 2) being able to have some considerations before making a decision, 3) being able to differentiate between facts and opinions, and 4) being able to face difficult problems (Susilo et al., 2018). The students evaluate their ideas and compare facts, evidence, and others' opinions (Ruggerio, 2012). The students also can develop leadership skills, effective communication, collaboration, and environmental awareness, and increase self-confidence (Kalonji, 2005). According to Iakovos (2011), critical thinking plays a significant role in developing certain skills, namely (a) explaining and clarifying; (b) asking questions correctly to clarify or express objections; (c) checking the reliability of sources; (d) problem solving and reasoning. Paul & Heaslip (1995) defines critical thinking as a learning process to improve students' self-discipline and independence. Critical thinking is essential in our education system, along with a constructivist approach as means to establish constructive education that produce students who are creative, productive, independent, open-minded, insightful, with strong characters (Arisoy & Aybek, 2021). The ability to think critically will bring a lot of advantages for the students if the teachers can develop it during the teaching-learning process.

Critical thinking is a valuable skill to master by the students as it helps them prevent future problems (Figliuolo, 2016). Additionally, Dorinengum (2019) conveys that critical thinking skills can be applied in the workplace in various ways depending on the types of business. Employees with critical thinking skills can avoid making wrong and hasty decisions, they can also use their ability to develop their company through market research and recognizing opportunities. According to Rayhanul and Islam (2015), critical thinking improves language and presentation skills as clear and systematic thinking can improve the way people express their ideas. Moreover, critical thinking also improves comprehension skills in learning how to analyze the logical structure of texts.

Critical thinking encourages the development of creative solutions to challenges that do not just include new ideas. These proposed new ideas must also be useful and relevant to the tasks at hand. For this reason, critical thinking plays a vital role in evaluating new ideas, and choosing the best revision if necessary. From Rayhanul and Islam (2015) view, critical thinking

is also important for self-reflection. Critical thinking in the view of Paul and Elder (2002) also enhances students' academic performance. Students who know how to analyze and criticize ideas are able to make connections across disciplines, see knowledge as useful and applicable to daily life and understand the content on a deeper, more lasting level.

Based on the expert opinions presented above, it can be concluded that critical thinking skills are important to be developed by teachers, so that prospective teachers can have a comprehensive understanding, come up with new ideas to design learning, and make the right decisions. Teachers with critical thinking skills will influence the development of the students' thinking skills. Thus, as prospective teachers, it is necessary to develop students' critical thinking skills.

2.3. Critical Thinking Indicators

There are six indicators of critical thinking proposed by Facione (2015), namely interpretation, analysis, summary, evaluation, and self-regulation. As stated by Ennis (1993), critical thinking indicators are derived from students' critical activities which contain critical thinking as follows: 1) producing a clear statement from each question; 2) reasoning; 3) knowing information well; 4) using credible sources and being able to mention them; 5) being relevant with the main idea; 6) linking ideas; 7) finding alternative; 8) open-minded; 9) Justification; 10) critical assessment; and 11) being organized. It is safe to conclude that the critical thinking indicators are: 1) formulating the main points of the problem; 2) disclosing the facts to solve the problem; 3) selecting logical, relevant, and specific arguments; 4) identifying biases based on different perspectives; 5) determining the result of the decisions made.

There are six aspects of critical thinking skills, shortened to FRISCO: Focus, Reason, Inference, Situation, Clarity, and Overview. The focus aspect helps individuals to clarify the issue or situation so that they can make the right decision based on what they believe. The reason aspect means knowing the causes that support or are against the decision made based on the relevant facts. The inference aspect means making a reasonable decision. The most important thing from this stage is identifying the assumption and finding the solution, considering the situation and proofs. The situation aspect means understanding the situation and always maintaining the situation when thinking because it will help the individual to focus and understand the key factors and supporting parts. The clarity aspect is explaining the meaning or terms used. Lastly, the overview aspect is about moving forward and reviewing the decision made (Ennis, 1996).

According to Krathwohl (2002), there are several indicators to measure students' critical thinking, namely: 1) Analyzing ability, including a) Analyzing incoming information and dividing or restructuring information into smaller parts to recognize patterns of relationship b) Recognizing and distinguishing the cause-and-effect factors of a complex scenario c) Identifying or formulating questions. 2) Evaluating ability, including a) Evaluating solutions, ideas, and methodologies using appropriate criteria or existing standards to determine their effectiveness and benefits b) Hypothesizing, criticizing, and testing c) Accepting or rejecting a question based on predetermined criteria. 3) Creating ability, including a) Generalizing an idea or way of looking at something b) Designing something to solve a problem c) Organizing elements or parts into a new structure that have never existed before. Meanwhile, Watson & Glaser Bernard et al., (2008) state that critical thinking skills have five aspects, consisting of making inferences, deductions, interpretations, recognizing assumptions, and evaluating arguments.

2.4. Gender

Gender is defined as a complex psychological and sociocultural concept of human that can influence sex characteristics (Davison, K., Queen, R., Lau, F., & Antonio, 2021). The World Health Organization (2021) refers to gender as the socially constructed roles, behaviors, activities, and attributes that are considered appropriate for females and males. The debates might seem outdated, nonetheless, gender scholars continue searching for pervasive gaps and contradictions comparing female and male roles. It is time to discuss gender roles and advocate explicitly and actively for more equitable roles, gender-inclusive classrooms, and

teachers who can facilitate equitable classroom practices, pedagogy, and curriculum.

Gender identity is a person's inner sense of gender rather than a person's observable or outward presentation of gender. The National Council of Teachers of English [NCTE] contends that gender identity is an individual's feeling about, relationship with, and understanding of gender as it pertains to their sense of self (NCTE, 2018) and it is usually expressed through a combination of outward factors such as one's demeanor, physical appearance, vocal range, social roles, occupations, and other factors, which are typically associated with "femininity" or "masculinity" and may or may not conform to conventional defined behaviors and characteristics.

Gender expression is described as how an individual outwardly displays or portrays their gender. It is idiosyncratic and can be contingent upon the context in which individuals are embedded. Meanwhile, sex is assigned at birth based on individuals' external anatomy and that is recorded on a birth certificate. Transgender and cisgender can be defined as when a person's gender identity does not and does match the sex assigned at birth, respectively. Finally, different from gender, sexual orientation, typically reflects individuals' preference and attraction toward others. In all these definitions, gender is distinguished from biological sex, which can be the same or different from the sex assigned to individuals at birth. It has been a common trend to use the terms gender and sex interchangeably, although they are distinct (Carl, 2012; GenIUSS Group, 2014; Westbrook, L., & Saperstein, 2015). In examining various attempts to explain these two terms, some sources define gender as a social construct – the physical and or social condition of being female or male, compared to sex as the state of being either female or male (Davison et al., 2021; Simpson et al., 2000). While most conventional social systems categorize gender as either feminine or masculine, the modern structure of society perceives gender as a spectrum rather than a binary. To move beyond the gender binary, it is essential to continue the discussions that "there's no reason why girls shouldn't play football, climb trees and get dirty, no more than there's any reason why boys shouldn't play with dolls if they want to and take an active interest in cookery" (Dixon & Foster, 1997). In summary, teachers must know about, comfort with, and have the clarity to facilitate conversations about gender and other related concepts with their students.

Furthermore, gender is shaped by discourse, language, practices, behaviors, and relations, through the socialization process (Adaçay, 2014). At the end of these socialization processes in the family and close environments, children reach school age with gender identity. After family, the cultural construction of gender roles continues in schools (Lindsey, 2016) because the school has an important role in transferring culture to individuals through education. Learning-teaching processes and the cultural climate of the schools are effective tools in teaching and reproducing dominant gendered stereotypes and related values. UNESCO (2015), a global organization, emphasized that gender equality should be promoted in teacher training institutions because since it is a priority in the international development agenda and plays a key role in the development of teachers' values, knowledge, human potential, and skills.

APA (2012) defines gender as the attitude, feelings, and behaviors that a given culture associates with a person's biological sex. Given the significant role teachers play in the lives of youth and the power that they have in shaping how youth view, explore, and experience gender in the school context, teachers have an ethical obligation to examine their views about gender, gender identity, gender stereotypes, and gender disparities in educational outcomes. Also important is teachers' awareness of how these beliefs may be implicated and ever-present in their daily behavior, and thinking (Bailey, 1994).

Based on the aforementioned opinions, it can be concluded that the concept of gender is a trait attached to men and women that is socially and culturally constructed. The formation of gender differences is due to many things being formed, socialized, strengthened, and even socially and culturally constructed through religious teachings and the state. Therefore, gender is not interpreted as a physical difference between men and women in a biological sense, it is a distinction of roles, attributes, traits, attitudes, and behaviors that grow and develop in society. It can also be interpreted as roles and behaviors formed by society through a

socialization process related to the female and male sex. Biological differences between women and men are often interpreted as a social demand regarding whether or not someone should behave in a certain way.

3. Method

3.1 Research Design

This study employed a quantitative research method. Sugiyono (2018) states that the quantitative method can be defined as the research method based on the positivist philosophy, used to study the population or certain samples. The data was collected using survey as a research instrument, followed by quantitative/statistical analysis, aiming to draw and test the hypothesis. According to Sukmadinata (2011), a survey is used to obtain a general overview of the population characteristics. There are three main characteristics of the survey; they are: 1) the data obtained from the big group aiming to describe many aspects and characteristics such as knowledge, behavior, beliefs, and skills, 2) the data obtained from the either written or verbal questions from the population, 2) the data gained from the sample, not the population. The researcher chose this method because the this study aimed is to analyze the critical thinking skills viewed from the gender perspective as the overview from the whole population. The data was obtained from the test, and the sample was taken from the students' representatives, both male and female. In addition, quantitative descriptive method was used as to analyze the data based on descriptive statistics.

3.2. Time, place, and subjects of the study

This study was conducted from August to October 2022 at Elementary School Teacher Education Department. The subjects of the study were elementary school prospective teachers comprising 25 male students and 25 female students. Second-semester students were purposefully selected because in that semester students got environmental pollution material. Students involved in the study were students who took human and environmental courses. Purposive sampling was the sampling technique employed, in accordance with the purpose/focus of this study. The selection of this purposeful sample included five male and female students as representatives from each class.

3.3. Data Collection

The instrument for data collection refers to Facione's theory of critical thinking that covers interpretation, analysis, evaluation, inference, explanation, and self-regulation. However, only five indicators were used in this study to adjust the material and questions, namely interpretation, analysis, evaluation, inference, and self-explanation. There were 10 questions in the instrument as presented below:

Table 1. Instrument of Critical Thinking Indicators according to Facione

Indicator	Sub-indicator
Interpretation	. Categorization
	. Decoding significance
	. Clarifying meaning
Analysis	. Examining ideas
	. Identifying arguments
	. Analyzing arguments
Evaluation	. Assessing claims/arguments
Inference	. Querying evidence
	. Conjecturing alternatives
	. Drawing conclusions
Explanation	. Stating results
	. Justifying procedures
	. Presenting arguments

The questions were validated by experts in the field of science learning in elementary school,

they were Dr. Idam Ragil Widiyanto Atmojo, M.Si. and Dr. Peduk Rintayati, M.Pd. The validation result used the Gregory formula. Every expert gave a score on each item with a range of 1-4. Next, the scores were calculated using the Gregory formula as displayed below:

Table 2. The Gregory Formula Tabulation

Tabulation 2 x 2		Expert 1	
		Less Relevant (score 1 – 2)	Relevant (score 3 – 4)
Expert 2	Less Relevant (score 1 – 2)	A	B
	Relevant (score 3 – 4)	C	D

Source: Retnawati, (2016)

Based on the table, the validation can be calculated using the Gregory formula as below:

$$VC = \frac{D}{A+B+C+D}$$

Note:

- VA : Content Validation
- A : Both experts disagree
- B : Expert 1 agrees; Expert 2 disagrees
- C : Expert 1 disagrees; Expert 2 agrees
- D : Both experts disagree

Criteria coefficient 0-1:

- 0.9-1.0 : Very high
- 0.6-0.89 : High
- 0.4-0.59 : Middle
- 0.2-0.39 : Low
- 0.0-0.19 : Very low

The validity test result was 0.83, signifying high validity, therefore the research instrument indicators were valid and could be used.

3.4. Data Analysis

In this study, researchers used quantitative data analysis method with a descriptive approach. A quantitative method is a study approach that primarily uses a postpositivist paradigm in developing science (such as exploring cause and effect, reduction to variables, hypotheses, and specific questions, using measurement and observation, and theory testing), using research strategies such as experiments and surveys that require statistical data (Emriz, 2008).

The results of this study covers critical thinking on environmental pollution material, in which the score is the accumulation of critical indicators i.e. interpretation, analysis, evaluation, inference, and explanation. The score is converted as the criteria below:

Table 3. Critical Thinking Skills Assessment Criteria

No	Final Score	Assessment Criteria
1	>3.25–4.00	Very Good
2.	>2.50–3.25	Good
3.	>1.75–2.50	Fair
4.	1.00–1.75	Low

4. Findings

The ability to think critically is evident in the test of 50 students who answered 10 questions in 60 minutes. The critical thinking analysis of 50 students was performed using the test answers that were compared based on the male and female gender. The result of critical thinking analysis in this study covered environmental pollution material. The critical thinking score

obtained was the accumulation of critical thinking skills indicators consisting of interpretation, analysis, evaluation, inference, and explanation. The test result was analyzed using the scoring instrument to categorize the critical thinking skills. Based on the result of the study, the recapitulation and test results of all the students were obtained as presented below:

Table 4. Critical Thinking Skills Result of Male Students

No	Indicator	Number of Items	Result	Average	Category
1.	Interpretation	1	2.75	2.69	Good
		2	2.64		
2.	Analysis	3	2.30	2.34	Fair
		4	2.39		
3.	Evaluation	5	2.15	2.09	Fair
		6	2.04		
4.	Inference	7	2.27	2.39	Fair
		8	2.51		
5.	Explanation	9	2.90	2.92	Good
		10	2.94		
Average				2.48	Fair

Table 4 shows the results of 25 male students' critical thinking skills. The result shows that the interpretation indicator gained an average of 2.68 and belonged to the good category. The second indicator was analysis, and it obtained an average of 2.34 with a fair category. The third indicator was evaluation that obtained an average of 2.09 with the fair category. The fourth indicator was inference that obtained an average of 2.39 with a fair category. The last indicator was explanation what obtained an average of 2.92 with a good category. It can be concluded that the biggest score from the male students was obtained from the explanation indicator with an average of 2.92, while the lowest indicator was evaluation with an average of 2.09, and it belonged to the fair category. The total average score of male students' critical thinking skills was 2.48 and it belonged to the fair category.

Table 5. Critical Thinking Skills Result of Female Students

No	Indicator	Number of Items	Result	Average	Category
1.	Interpretation	1	3.18	3.31	Very Good
		2	2.95		
2.	Analysis	3	3.00	3.01	Good
		4	3.03		
3.	Evaluation	5	2.90	3.00	Good
		6	3.10		
4.	Inference	7	3.23	3.15	Good
		8	3.40		
5.	Explanation	9	3.09	3.32	Very Good
		10	3.55		
Average				3.15	Good

Table 5 shows the results of 25 female students' critical thinking skills. The result shows that the interpretation indicator reached an average of 3.31 and belonged to the very good category. The second indicator was analysis which resulted in an average of 3.01 with the good category. The third indicator was evaluation that obtained an average of 3.00 with the good category. The fourth indicator was the inference which reached an average of 3.15 with the very good category. The last indicator was explanation that obtained an average of 3.23 with the good category. It can be concluded that the biggest result from female critical thinking skills was explanation with an average of 3.32 with a very good category, covering sub-

indicator reasoning, while the lowest indicator was evaluation, gaining an average of 3.00 with a good category. The total average score of female students' critical thinking skills was 3.15 and it belonged to the good category.

The detail of male and female students' critical thinking skills can be seen on the chart below.

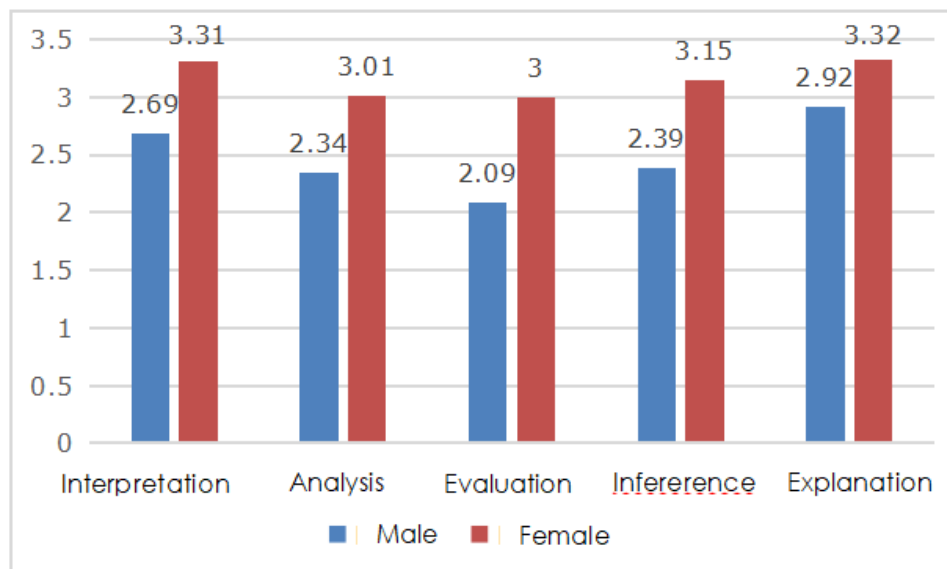


Figure 1. Comparison of Male and Female Critical Thinking Skills

Based on the chart above, it can be seen that there were differences in critical thinking skills between male and female students. For the interpretation aspect, the male students scored 2.69 and the female students scored 3.31; for the analysis aspect, the male students scored 2.34 and the female students scored 3.01; for the evaluation aspect, the male students scored 2.09, and the female students scored 3; for the inference aspect, the male students scored 2.39, and the female students scored 3.15; while for the explanation aspect, the male students scored 2.92, and the female students scored 3.32.

5. Discussion

There are some differences in each indicator of critical thinking skills of male and female students. Data analysis of female students resulted in a higher average than male students. The following is the description of each indicator:

Interpretation indicator entails the ability to understand the meaning of experiences, situations, data, events, judgments, conversions, beliefs, rules, procedures, or criteria (Facione, 2015). Interpretation skill is the ability to understand the problem indicated by writing what is known or the question asked correctly. Female subjects were able to categorize, describe and clarify the meaning, as evidenced by item 1 getting a score of 3.18 and item 2 getting a score of 2.95, and on average getting a score of 3.31 with a very good category. Meanwhile, the male subjects in item 1 obtained a score of 2.75 and item 2 obtained a score of 2.64, with the average score of the male subject's interpretation indicator being 2.69 in the good category. This result is in line with Ricketts and Rudd (2004) who also found that females' critical thinking ability scores are higher than males. Females are judged to be better at problem-solving, formulating statements and questions, delineating concepts, offering justifications and opinions, and being able to draw conclusions.

The second indicator is analysis. Analysis skills of female students' are superior to those of male students'. Female subjects were able to examine ideas, identify arguments, and analyze arguments as evidenced by item 3 of 3.00 and item 4 of 3.03, while male subjects' analysis skills were proven by item 3 of 2.30 and item 4 of 2.39. The results show that female subject analysis indicators are 3.01 in the good category, while the results of the analysis of male subject

analysis indicators get an average of 2.34 with fair categories. According to Anderson & Krathwohl (2010), analysis indicators break down information into several sections to explore understanding and relationships, compare, organize, deconstruct, interrogate, and discover (Sadijah, et. al., 2021). A previous study conducted by Wardani et., al. (2018) also stated that the ability of female students to analyze is better than males.

The third indicator is evaluation. The results of the analysis show that the female subjects were able to assess/determine the statement or reason as evidenced by item 5 of 2.90 and item 6 of 3.10. The results of the analysis of evaluation indicator for female subjects obtained an average of 3.00 in the good category. The male subject was fairly able to assess/determine the statement or reason as evidenced by item 5 of 2.15 and item 6 of 2.04. The result of the analysis of the evaluation indicator for male subjects obtained an average of 2.09 with a fair category. The evaluation indicator contained an assessment of a statement of information that was judged to be true and accurate. Evaluation activities require an understanding of the correct knowledge so that its credibility can be accounted for. Evaluation correlates statements by deciding to distinguish between strong and weak arguments, and arguments become meaningful when they are directly related to the question (Kumar.R & James., 2015).

The fourth indicator, inference, is to identify and determine aspects to make conclusions, and hypotheses, and consider the information obtained (Facione, 2015). Male subjects were able to ask for facts/information/evidence, estimate alternatives, and conclude as evidenced by item 7 of 2.27 and item 8 of 2.51. The results of the inference indicator analysis of male subjects obtained an average of 2.39 in the good category while female subjects' inference skills were evidenced by item 7 of 3.23 with an item 8 is 3.40. The results of the inference indicator analysis of female subjects obtained an average of 3.15 in the good category. Utami et al. (2023) convey that inference means that students can conclude the answers that have been completed. This finding is consistent with studies showing that women achieve higher inference scores than men. This signifies that female students are more adept at recognizing the elements required to conclude, formulate hypotheses, and take pertinent data into account (Cahyono, 2017).

The fifth indicator is explanation. Critical thinking requires the ability to provide explanations. A good explanation leads to the aspect one wants to address and is correct. Students who provide explanations correctly indicate good learning outcomes. Understanding knowledge leads to being able to argue correctly. Male subjects were able to determine results, present procedures, and show reasons, as evidenced by item 9 of 2.90 and item 10 of 2.94. Meanwhile in the same aspect, female subjects obtained 3.09 for item 9 and 3.55 for item 10. The results of the analysis of the female subject's explanation indicator obtained an average of 3.32 in the very good category. Meanwhile, the results of the analysis of the explanation indicator for male subjects obtained an average of 2.92 in the good category. This indicator ranked the highest compared to other indicators, and it was due to the habits and experiences they have had. Analyzing process entails explaining relevant information, linking relationships with relevant elements, and determining ideas for the information obtained (Anderson & Krathwohl, 2010). According to the study's findings, female students had higher mean values for each index than male students. The difference in mean values resulted from the fact that female students outperformed male students in critical thinking tests when it came to analyzing and drawing conclusions. This outcome is in line with a study by Mahanal, et.al. (2012) who used higher mean values of critical thinking adjustment for females than for males, demonstrating how gender influences the development of critical thinking skills.

Facione (1990) states that critical thinking is an essential requirement for an individual in the information era. He emphasizes that students learn critical thinking and other higher-order thinking abilities by designing a constructive curriculum. A constructive learning environment is designed for the students so they can be responsible, be active learners, and always improve their characteristics. Critical thinking is one of the skills possessed by an individual to develop life-long active learning (Gibby, 2013). Moreover, developing critical thinking is also a requirement for an individual to be an active member of a democratic society (Çelik &

Özdemir, 2020). Critical thinking is an active intellectual discipline process that involves considering, putting into practice, analyzing, synthesizing, and/or evaluating information gleaned from observation, experience, reflection, understanding, and communication as beliefs and acts (Paul and Elder, 2012).

It can be stated that gender differences influenced the students' critical thinking skills in solving the question concerning environmental pollution. It was revealed that female students had better critical thinking skills by achieving good and very good categories than male students did. The inferior state of the male students' critical thinking skills was due to the fact that one of the indicators was in a fair category. It is in line with Duran (2021) who state that gender biological growth has caused a significant difference between learning outcomes and critical thinking skills.

This study is similar to that of Cahyono (2017) who suggests that there are differences in the process and results of critical thinking tests between male and female subjects in teaching geometric transformations of materials in three parallel classes with the same teacher. This study also shows that gender differences affect students' critical thinking in solving social arithmetic problems. Females have higher, average, and lower critical thinking skills than males. Another study by Haryanto, et.al. (2022) concludes that female students perform better than male students, supported by an interesting finding that female students had better vocabulary than male students. The difference between male and female critical thinking was 6%, not a significant gap, but both males and females scored points in the subcategory. This study also shows that for each indicator, there were not many significant differences between males and females in terms of critical thinking, but females still scored better than males. Thus, females with average self-confidence and critical thinking skills outperformed males with average self-confidence.

This study provides the benefits that gender differences can influence students' abilities. Researchers suggest that educators take this finding into account because the treatment given by teachers in facilitating students' development abilities can be maximized if teachers know the gender characteristics. This study is also useful for future researchers to pay attention to other factors that can influence critical thinking skills.

6. Conclusion

The data analysis on the elementary school prospective teachers' critical thinking skills viewed from gender perspective on environmental pollution material presents that female students are superior to male ones. The data analysis shows that the average of every indicator in females is higher with 3.1 in the good category, while the males' average is 2.4 in the fair category. During the learning process, the teachers have to pay attention to gender differences, particularly in training both male and female students' critical thinking skills, which can manifested in form of implementing supportive learning methods, and facilitating learning styles so they can develop their critical thinking skills through problem-solving on various questions.

Limitation

The limitation of this study is that researchers only used small scale research subjects. Researchers also cannot control other variables that can influence students' critical thinking skills.

Recommendation

Recommendations for future researchers are to analyze the skills required in the 21st century, such as communication skill, collaboration skill, and creative thinking in gender perspective. Researchers can also conduct a further study on the factors that influence the differences in critical thinking skills of male and female students.

Acknowledgments

The researchers would like to thank various parties who helped carry out the study, particularly the prospective teachers who were willing to be studied, and the department that provided the opportunity to conduct this study.

Conflict of Interest

There were no conflicts of interest during the completion of this study and the article publication.

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