

Analysis of The Critical Thinking Style of Prospective Biology Teachers Students

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Abstract: A person's critical thinking style will determine the extent of critical thinking skills. This study examines differences in the critical thinking styles of biology teacher candidates based on academic level. The method applied in this study is non-experimental with a comparative design. The instrument used was the Yanpiaw Creative-Critical Style Test, which was given to several prospective biology teacher students from semester 2, semester 4, semester 6, and semester 8 as respondents. The results showed that there was a significant difference between the average critical thinking style between students in semester 2 and semester 6 (sig. 0.011 < 0.05) and between semester 2 and semester 8 (sig. 0.029 < 0.05). Based on the findings, it can be concluded that academic level or level does not always affect a person's critical thinking style. However, it is also possible due to academic majors, behavior style, and ethnicity (culture). Therefore, an educator needs to provide learning methods and media that can support the development of students' critical thinking styles.

Keywords: Biology Teacher Students; Critical Thinking Style; Prospective; Ycreative-Criticals

Introduction

One of the goals of higher education is to produce graduates who have critical thinking skills, where a person's thinking style strongly influences critical thinking skills. This means that one's critical thinking skills can be improved through learning that involves thinking styles in the process. Knowing students' thinking styles can improve academic fields such as learning processes, assessments, curriculum development, and non-academic fields (Abdi, 2012). This aligns with the statement (Owens & Lamm, 2016) that thinking styles can be used as material for consideration in developing an education program. Barrick & Dibenedetto, (2019) added that students must understand learning content and be equipped with reasoning, critical thinking, and problem-solving skills. Therefore, tertiary institutions must be able to improve professional development, curriculum, and learning processes by considering students' critical thinking styles. Hamid et al., (2021); Piaw, (2014) explains that critical thinking style is a person's tendency to think

critically and creatively. Thinking style will determine a person's critical and creative thinking spirit, such as skills in analysis, self-regulation, and ability to solve problems and find solutions to existing problems. In addition Zhang, (2003) revealed that thinking styles can affect a person's critical thinking disposition. A person's thinking style tends to be influenced by several positive factors, including the approaches and methods used in the learning process, the level of cognitive development, and open-mindedness.

A person can be said to have a critical thinking style if he is able to be consistent, think logically and accurately, have reasoning skills, argue, analyze, predict, and anticipate. Meanwhile, someone with a creative thinking style has characteristics such as being able to produce unique, imaginative ideas, interpret, recognize different ideas or objects, and be a little emotional (Saien et al., 2019). Sajedi, (2018) in his research explains that critical thinking styles, both legislative, judicial, general, liberal, and internal, have a positive relationship to creativity and partial and conservative thinking styles, and vice versa. This

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confirms that the education system must pay attention to the ultimate goal, such as graduates who can be creative and think critically, which play a role in supporting the effectiveness of the educational process and will ultimately influence the development of society.

It is stated that thinking style is not the same as thinking strategy because it is generally how a person receives and processes information in all conditions dynamically and stably. Meanwhile, thinking strategies are how a person processes information under certain conditions and tend to be slow (Ellala et al., 2020). Everyone has a different style of thinking that will determine the level of flexibility, cognitive preferences, and individual linguistics. Meltzer, (2007) reveals that there are five dimensions of a person's thinking style, namely 1) methods of thinking in form, 2) methods of thinking based on functions, 3) methods of thinking based on levels, 4) methods of thinking based on trends and tendencies, 5) methods of thinking based on domains. (Emir, (2013) explains that according to the theory of Mental Self-Government, there are 13 (thirteen) critical thinking styles in five dimensions, namely 1) the functional dimension, which includes three basic thinking styles: legislative, executive, and judicial thinking styles, 2) the form dimension includes five thinking styles namely monarchy, hierarchical, oligarchic, and anarchic, 3) the level dimension includes two styles of thinking, namely global and local thinking styles, 4) the scope dimension includes two thinking styles, namely internal and external thinking styles, and 5) the learning dimension includes The 2 styles of thinking are conservative and liberal.

Several previous studies have been conducted on the critical thinking skills of prospective biology teachers (Nurdiana et al., 2023; Maryuningsih et al., 2019; Roviati et al., 2019), but no studies have been found regarding their critical thinking styles. In fact, critical thinking cannot be separated from critical thinking style, so this is the newest point in this research. A student, especially teacher candidates, are required to be able to have the ability to think creatively and critically. This is relevant to Nuraini, (2017) statement that prospective biology teacher students are required to have the ability to think critically, be competitive, and be able to face problems in the 21st century. Syahfitri & Firman, (2022) state that higher education is essential in preparing individuals to have skills in the environment. Several factors influence each other, such as critical thinking dispositions, critical thinking skills, and including thinking styles. According to Padget, (2012) critical and creativity are sweet concepts, where both are part of the learning process that someone has accepted. Criticism and creativity can be seen in the changes in personality, problem-solving

skills, and motivation resulting from the learning process. A person can be called creative if the existing motivation arises from oneself as an effort to achieve predetermined goals.

One of the efforts that can be made to develop and improve students' critical and creative thinking skills is by identifying their thinking style. Thus, it is hoped that it will provide an overview of the thinking style possessed by prospective teacher students. In the end, educators can determine solutions to problems encountered, such as determining the learning methods and teaching media used.

Method

This study applied a non-experimental research design with a comparative descriptive design, designed to describe variables by comparing two or more variables to see the differences through descriptive and inferential statistical analysis (Heryana et al., 2020). This study involved prospective biology teacher students as respondents from two universities. Data was collected by distributing the Yanpiaw Creative-Critical Style Test instrument to prospective biology teacher students in semester 2, semester 4, semester 6, and semester 8. The Yanpiaw Creative-Critical Style Test was an instrument developed by (Piaw, 2010). The instrument has fulfilled the validity and reliability tests. The results of the reliability test evidence this through the product-moment, namely 0.90 for the total score, 0.81 for the critical thinking style, and 0.85 for the creative thinking style (Piaw, 2010). The Yanpiaw Creative-Critical Style Test instrument consists of 34 question items.

The data obtained was analyzed by interpreting it based on 5 criteria and categorizing critical thinking styles according to (Chua, 2018), as seen in Figure 1. This aims to determine the categories of critical thinking styles of prospective biology teacher students each semester. Furthermore, researchers used two-way ANOVA analysis to find significant differences in critical thinking styles between prospective teacher students in different semesters.

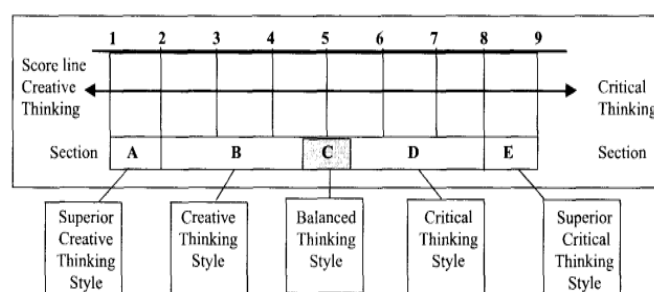


Figure 1. Interpretation of The Yanpiaw Creative-Criticals Scoring Indicator (Chua, 2018)

Figure 1 is a guideline for interpreting the critical thinking style of prospective biology teacher students, namely by adjusting the position of the scores on a straight line of Creative thinking. For scores in the range 1.0 – 2.0, it is called section A with a Superior Creative Thinking Style interpretation; for scores in the range 2.1 – 4.5, it is called section B with a Creative Thinking Style interpretation; for scores in the range 4.6 – 5.5 it is called section C with a Balanced Thinking Style interpretation, for scores in the range 4.6 – 5.5 it is called section C with a Balanced Thinking Style interpretation. Scores in the range 5.6 – 8.0 are called Section D with a Critical Thinking Style interpretation, and scores in the range 8.1 – 9.0 are called Section E with a Superior Critical Thinking Style interpretation.

Result and Discussion

Result

After the Yanpiaw Creative-Criticals Style Test (YCCST) was distributed to prospective biology teacher students with 95 students who filled out the instrument, the data obtained was analyzed descriptively first. The results of data analysis and interpretation of the grouping of critical thinking styles can be seen in Table 1.

Table 1. Result of Analysis and Interpretation of Descriptive Statistics

Level	SD.	N	Min	Max	Mean	Interpretation
2	0.45	23	5.24	6.91	5.97	Balanced Thinking Style
4	0.68	25	4.41	7.38	5.55	Balanced Thinking Style
6	0.58	26	4.32	6.53	5.41	Balanced Thinking Style
8	0.71	21	4.32	6.53	5.44	Balanced Thinking Style

Table 1 describes that overall biology teacher candidates from semester 2, semester 4, semester 6 and semester 8 have a balanced critical thinking style. The data shows that semester 2 has the highest average critical thinking style score of 5.97, followed by semester 4 with an average score of 5.55, semester 8 with an average score of 5.44, and semester 6 with an average score of 5.41. Furthermore, a one-way ANOVA test analysis was carried out to see the difference in the significance of critical thinking styles in each semester with the results shown in Table 2.

Table 2 explains the results of the one-way ANOVA test analysis obtained a significance value of $0.009 < 0.05$, so it can be concluded that prospective biology teacher students from an average of the four semesters have significant differences in critical thinking styles.

Therefore, to find out which semesters have significantly different average critical thinking styles, a Post Hoc Test is carried out through the Turkey test. The further test results can be seen in Table 3.

Table 2. One-Way Anava Test Results

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	45.783	3	15261.059	4.064	0.009
Within Groups	341.745	91	3755.443		
Total	387.529	94			

Table 3. Results of the Turkey Significance Different Test Analysis

(I) Semester	(J) Semester	Mean Difference (I-J)	Sig.
Semester 2	semester 4	41.565	0.095
	semester 6	55.488*	0.011
	semester 8	52.327*	0.029
semester 4	Semester 2	-41.565	0.095
	semester 6	13.923	0.849
	semester 8	10.762	0.934
semester 6	Semester 2	-55.488*	0.011
	semester 4	-13.923	0.849
	semester 8	-3.161	0.998
semester 8	Semester 2	-52.327*	0.029
	semester 4	-10.762	0.934
	semester 6	3.161	0.998

Based on Table 3 above, it is known that the semesters that have significant differences in average critical thinking styles are between semesters 2 and semester 6 with a significance value of $0.011 < 0.05$ and between semesters 2 and semester 8 with a significance value of $0.029 < 0.05$. Meanwhile, between semester 2 and semester 4, semester 4 and semester 6, and semester 4 and semester 8 did not show significant differences in critical thinking styles. This is shown by the significance value, which is more than 0.05.

Discussion

Biology teacher candidates with a balanced critical thinking style tend to have the same average creative thinking and critical thinking skills. In addition, students with this thinking style can already use their skills to solve their problems. However, someone with a critical thinking style like this requires improving their competencies through learning such as mental arithmetic mind mapping.

Significant differences in critical thinking styles in students from each semester may be caused by gender, ethnicity, style of behavior, or attitudes and habits they have. The behavior style in question is a person's style or habit in addressing and solving problems, one's habits

in learning. (Mohamad et al., 2017) revealed that learning styles will reflect a person's attitude in their learning process preferences, whether through observing, listening, acting, reasoning, memorizing, or visualizing. Different student learning styles will determine differences in a person's critical thinking abilities. Learning styles and critical thinking skills are competencies needed to deal with advances in science and technology. Through these competencies, students will be able to solve problems and make decisions on the problems they are facing. In the results of the Dilekli, (2017) research state that a person's learning style has a close relationship with his critical thinking attitude. Myers & Dyer, (2006) explain that someone with a deep and sequential learning style shows higher critical thinking than other students. Students will demonstrate an attitude of being able to consciously use and analyze scientific thinking and control themselves from emotions in a situation that is being faced. In addition, differences in the critical thinking styles of prospective teacher students are thought to be influenced by academic majors. This is in line with the statement of (Lun et al., 2010), which explains that a person's critical thinking can ideally develop determined by his academic environment and culture or ethnicity. Wahyudi et al., (2023) stated that the factors that might cause differences in critical thinking styles are ethnicity, gender, and learning ability. This is in line with Chua's statement (2014), which states that the factors that influence differences in a person's thinking style are gender, ethnicity, level of academic major, and thinking ability.

From the data analysis results, prospective teacher students who are in semester 2 have the highest average critical thinking style, which explains that the academic level or level of a student does not always affect a person's critical thinking style. Of course, this contradicts the results of research conducted by Syahfitri et al., (2019), which states that a person's critical thinking can develop over time, so this statement means that the higher the level or semester of a student, the ability to think critically should also develop. Based on the researcher's analysis results, this is caused by several factors, including the learning process received by students and learning methods. It is known that students in the upper semester must carry out the learning process online due to the pandemic, so it can be said that the learning process received by students is not optimal in contrast to students who are in semester 2, who are students who have done face-to-face normal learning. Thus, the findings of cases like this confirm that an educator needs to determine effective learning methods and media for student-teacher candidates by considering the situations and conditions faced. This is

in line with the statement Shirazi & Heidari, (2019) that an educator needs to consider the learning styles of students in class before planning and using learning media and methods. Mahmood & Othman, (2020) added that an educator should be able to understand the characteristics of student learning styles and think critically. Media and learning methods that consider learning styles are very relevant to the concept of 21st-century learning. Samsudin & Hardini, (2019) state that to hone and foster students' critical thinking, it is necessary to pay attention to student learning styles. Therefore, educators need to prepare appropriate learning media and methods according to the needs and characteristics of students. It is hoped that learning can encourage students to channel their creativity. Fuad, (2020) added that active learning that involves students as learning centers through debate and discussion will be able to improve student learning styles, which then impact their critical thinking skills. Riyan Rizaldi et al., (2021) stated that each student has a different learning style and each student also has a different way and speed of receiving and processing information. Some students prefer audio learning, but some students like learning by reading. Some students also feel that learning will be effective if they do it themselves (practice), for example, in a practicum experiment or simulation.

Conclusion

Based on the results obtained, it can be concluded that prospective biology teacher students have relatively the same critical thinking style in each semester (level), which is in the Balanced Thinking Style category. This balanced student thinking style is possible due to factors such as one's behavior style, which is influenced by one's attitude of awareness, domination, influence, and stability in learning. Also, a person's thinking style can be influenced by gender. Thus, as an educator, it is necessary to determine what learning methods and media can support the development of a person's critical thinking style. It is important for future researchers to examine the differences in critical thinking styles of prospective teacher students from different majors.

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Author Contribution

The author contributed fully to this research

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Conflicts of Interest

The researcher states that this research does not involve any conflict of interest

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