



The Influence of Cognitive Style on Students' Critical Thinking Skills in Physics Material

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Abstract: This research aims to determine the influence of cognitive style on students' critical thinking abilities. This research uses a quasi-experimental method with a factorial design research design. The research subjects consisted of class XI MAN 1 Central Lombok students who were divided into experimental classes and control classes. The experimental class uses the PBL model, while the control class uses a conventional learning model. Research instruments include critical thinking ability tests and the Group Embedded Figures Test (GEFT) cognitive style test. Before the critical thinking ability test instrument is given, a test of the instrument is first carried out, namely a validity and reliability test level of difficulty, and distinguishing power. The research results show that the significant level value is 0.001 which is smaller than α which is equal to 0.05 ($0.000 < 0.05$). These findings indicate that there is an influence of cognitive style on students' critical thinking abilities.

Keywords: Critical Thinking Ability, Cognitive Style, Field Independent, Field Dependent

Introduction

Critical thinking skills are essential to functioning effectively in all aspects of life. According to Susilawati et al. (2020), critical thinking is a high-level thinking skill that can improve students' critical analytical skills. Satwika et al. (2018) also stated that critical thinking must be applied by memorizing theories, analyzing and understanding their meaning, and acquiring practical skills for life in society.

Critical thinking in the 21st century is one of the skills that students must possess in order to compete in the era of globalization. Students who have critical thinking skills can study problems systematically, face millions of challenges in an organized way, formulate questions, be innovative, and design solutions that are considered relatively new (Men Efrem, 2017).

Various methods are used to improve critical thinking skills, one of which is in the learning process. Learning will not take place if there is no teacher as a teacher. In making a learning plan, teachers must be able to choose and determine a learning model appropriate

to the material being taught. Teachers have different teaching styles, but teachers must be able to adjust the learning environment to the conditions of the students so that there is a positive interaction between the teacher and the students (Pritchard, 2009). This positive interaction can be achieved by understanding the characteristics of the students (Rusnilawarni, 2017). The characteristics in question are how students respond to something when faced with learning situations and conditions. One of the characteristics of students that must be considered in choosing and implementing a learning model and achieving learning outcomes is the difference in students' cognitive styles. Cognitive style is a typical characteristic of students learning how to receive information, attitudes towards the information they receive, or habits towards the learning environment (Wijaya, 2020). Each student has a different cognitive style from one another. In learning, teachers are required to be able to assess the type of cognitive style of students and then choose and apply the suitable learning model according to the differences in the cognitive styles of the students. Students with a field-independent cognitive

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style generally process the information they receive in learning. In contrast, students with a field-dependent cognitive style generally accept the existing information (Wijaya, 2020).

Students with a field-independent cognitive style are generally more independent in learning and are curious about a field and the problems they like. They like learning, which involves their activities in finding knowledge. The knowledge they obtain will be understood more quickly and stored in their memory longer. Students with a field-dependent learning style generally need help from others in understanding learning information. They prefer to learn something specific, do not like independent tasks, and have good imagination skills. Based on the description above, it encourages researchers to research the influence of cognitive style on students' critical thinking skills.

Method

The type of research used is quasi-experimental, with the research design used being factorial. This study used experimental and control classes and was conducted from April to May 2024 at MAN 1 Central Lombok. The population of this study were students of class XI MIPA 1 as the control class and students of class XI MIPA 2 as the experimental class for the 2023/2024 academic year. Sampling in this study used purposive sampling, a sampling technique using special considerations regarding the sample to be taken. This study includes three variables: the independent variable in the form of a problem-based learning model, the dependent variable in critical thinking skills, and the moderator variable in cognitive style. Data were collected using pretest and posttest essay test questions in the experimental and control classes to measure students' critical thinking skills and a cognitive style questionnaire in the form of the Group Embedded Figure Test (GEFT) Instrument. The researcher validated the essay test questions by testing them first in class X E-5. Questions that are declared valid are then applied to students. The data collected in this study are quantitative and then analyzed using the two-way ANOVA method and SPSS. This analysis aims to assess differences in critical thinking skills reviewed based on students' cognitive styles between the experimental and control groups.

Result and Discussion

The results of this study include students' critical thinking skills, as seen from their cognitive styles. In learning activities, the variables measured are students' critical thinking skills by considering the characteristics of the cognitive styles possessed by each student. This

measurement was carried out before giving treatment to each class. Both classes must complete the Group Embedded Figure Test (GEFT) Instrument to determine the students' cognitive styles. Afterwards, students will be given a pretest through essay test questions arranged based on critical thinking indicators. After the pretest, each class will receive different treatments. The control class uses a conventional learning model, while the experimental class uses a problem-based learning model. In the experimental class, students will be given contextual problems related to the subject matter, which they will discuss and solve in groups. After being given treatment, at the end of the meeting, participants will be given a posttest using the same questions as the pretest.

Students' cognitive style, as a moderator variable, was measured using the GEFT test. The distribution of cognitive style in the experimental class was 52% field-independent and 48% field-dependent, while in the control class, it was 46% field-independent and 54% field-dependent. Critical thinking skills based on cognitive style showed that students with field-independent cognitive style in the experimental class had an average score of 75.45, higher than students in the control class, who had an average score of 66.73. Students with a dependent cognitive style in the experimental class had an average score of 70.83, also higher than students in the control class, who had an average score of 58.64.

Hypothesis test analysis using the two-way ANOVA parametric statistical test showed that the problem-based learning model had a significant effect on students' critical thinking skills ($p < 0.05$). In addition, cognitive style also had a significant effect on students' critical thinking skills ($p < 0.05$). However, there was no significant interaction between the problem-based learning model and cognitive style on students' critical thinking skills ($p > 0.05$). The results of the hypothesis test can be seen in Table 1.

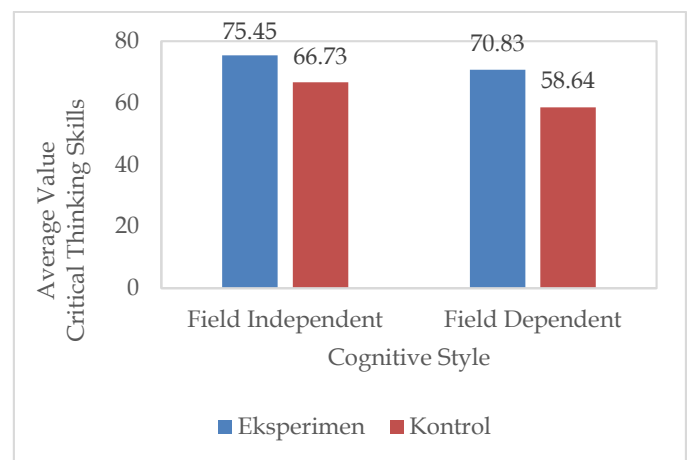


Figure 1. Comparison of critical thinking skills based on students' cognitive styles.

Table 1. Average Level of Critical Thinking Skills per Student Indicator

Class	Cognitive Style	Average level of Critical Thinking Ability per Indicator				
		A	B	C	D	E
Experiment	Field Independent (13 student)	68	85	69	74	71
	Field Dependent (12 student)	63	70	59	65	66
Control	Field Independent (13 student)	62	65	66	64	66
	Field Dependent (11 student)	44	51	44	49	55

Information

- A : Interpretation
- B : Analysis
- C : Evaluation
- D : Inference
- E : Explanation

Each individual has different learning characteristics, one of which is cognitive style. This study categorizes students' cognitive styles into field-dependent and field-independent, based on the theory of Witkin et al. (1977). Students with field-independent cognitive styles tend to be more able to process information analytically and independently, while students with field-dependent cognitive styles are more dependent on external structures and tend to see information as a whole (Pritchard, 2009).

The results of this study indicate that students with field-independent cognitive styles experience a higher increase in critical thinking skills than students with field-dependent cognitive styles. This shows that cognitive style affects students' critical thinking skills. According to research by Onyekuru (2015), students with field-independent cognitive styles can better develop their critical thinking skills because they tend to process information more deeply and analytically.

In the experimental and control classes, the division of heterogeneous groups allows students with field-independent and field-dependent cognitive styles to exchange knowledge. This allows for an optimal exchange of ideas and understanding so that students' critical thinking skills do not differ significantly between the two cognitive styles. This study supports the findings of Aryawati et al. (2020), who stated that interactions between students with different cognitive styles can enrich the learning process and improve critical thinking skills.

Conclusion

Cognitive style influences students' critical thinking abilities, where students with a Field Independent cognitive style tend to have higher critical thinking abilities compared to students with a Field Dependent cognitive style.

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Conflicts of Interest

The authors declare no conflict of interest.

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