

Analysis of Learning Outcomes of Biology Based Reflective and Impulsive Cognitive Styles

Imas Cintamulya

Department of Biology Education, University of PGRI Ronggolawe Tuban
warli66@gmail.com

Abstract— One's learning style, influenced by differences in how to process and treat the activities that psychology called cognitive style. Cognitive styles according to tempo conceptual can be divided into reflective and impulsive cognitive styles. Based on this do study aimed to determine differences learning outcomes of biology based on reflective and impulsive cognitive styles in students of biology education University PGRI Ronggolawe Tuban class of 2011. To see learning outcomes of biology are obtained based on the value in the subject of plant morphology, plant anatomy, basic genetics, plant development, and molecular genetics. To measure the reflective and impulsive cognitive styles, the study used a MFFT (Matching Familiar Figure Test) instrument which was designed and developed by Warli (2010). The results of measurements of cognitive style on 33 students each were obtained 11 students reflective and impulsive cognitive style or amounts to 66.6%. To examine the differences in learning outcomes of biology student who have a reflective and impulsive cognitive style were analyzed by two-factor Anova using IBM SPSS Statistics 19 program. The results showed that learning outcomes of biology students who have a impulsive cognitive style is better than students who have a reflective cognitive style.

Keywords: *biology, cognitive style, impulsive, learning outcomes, reflective.*

I. INTRODUCTION

Learning is the process of student interaction with the lecturers and learning resources in a learning environment. Implementation of the learning process takes place in the form of interaction between lecturer, students, and learning resources in a particular learning environment [1]. The learning process is a conscious activity between lecturer and students that aims to produce a change in behavior of students in terms of knowledge, skills, and attitudes. In general, changes in student behavior after learning activities demonstrated through learning outcomes. Learning outcomes can describe the capabilities of a person after experiencing a learning process. Learning outcome is also proof of the success already achieved someone or maximum result is achieved someone after making efforts to learn [11].

Learning outcomes of each individual will be different from each other, but the learning process is given to learners are the same. This is because that each individual has specific characteristics, which are not owned by other individuals. Therefore it can be said that every individual is different from one another. This difference is of course caused by many factors. According [8]. that the learning outcomes are influenced by internal factors are derived from the individual's own and external factors that come from the environment. One of the internal factors that influence the outcome of one's learning is learning style. [12] describes the aspects related to the personality of students, one of which cognitive function. Cognitive function related to student learning outcomes of cognitive aspects include: the level of intelligence, creativity, special talents, cognitive organization, level of proficiency, the power of fantasy, learning styles (cognitive styles, types of learning, thinking styles, techniques and methods), One of the characteristics of students who need to be understood by an educator in the achievement of learning outcomes are the differences in learning styles of learners. The difference in the person's learning style resulting in the ability to understand and absorb the lessons would be different.

[10] explains that learning style is the way learners about how to use / exploit information. Using information as an approach for students in understanding the lesson material with logic, systematic way or approach for learners with learning to understand, use, and learn to memorize. A person's learning style is influenced by cognitive style, namely a distinctive way to a person in learning whether related the

acceptance and processing of information, attitudes toward information, nor the habits related to the learning environment. According [8] each individual besides different at the level of problem-solving skills, level of intelligence, or the ability to think, may also differ in the way of acquiring, storing and applying knowledge. They can be differ in approach to learning situations, in the way they receive, organize and connect their experiences, in the way they respond to certain teaching methods. Differences between personal settling into ways of arranging and processing information and experiences known as cognitive style.

Cognitive style is an important factor that must be considered by the lecturers in the learning process. According to [1] if the student styles in learning are accommodated, that it can be improve the attitude of learning, thinking skills, academic achievement, and creativity. Cognitive style is a characteristic that tends to remain on a person in terms of feel, remember, organize, process, think, and solve problems to [4] and [2]. While [3] explains that cognitive style is individual variation in terms of feel, remembering, thinking, or as a way to distinguish, understand, save, embody, and use information. Cognitive style of many kinds, one of which cognitive style was found by Jerome Kagan in 1965, covers an reflective cognitive style and impulsive. Someone who has the characteristics of quick in answering the problem, but lacking / not carefully controlled so that the answers tend to be wrong, This it can say that a person is impulsive cognitive style. While someone with a slow in answering the problem, but carefully and thoroughly so that the answers tend to be true, that it can be said that the person's reflective cognitive style [10].

Cognitive style could have a positive or negative relationship with motivation, academic achievement depends on the nature of the learning task. Cognitive style has the following characteristics: 1) put more attention on the shape of the contents of cognitive activity. This refers to individual differences in terms of, feel, have, solve problems, and connect with other people; 2) cognitive style is a dimension to penetrate; 3) cognitive style is fixed, does not mean it can not change; 4) taking into account the value, cognitive style is bipolar [9].

Biology as a branch of Natural Science which focus the discussion on biological problems through the process and scientific attitude. As a branch of science, then in biology learning is learning-oriented nature of science that includes products, processes, and scientific attitudes through the process skill [7]. Subjects plant morphology, plant anatomy, plant development, basic genetics, and molecular genetics, including in the biological sciences. Learning from the fifth subjects has not just memorize facts, principles, and theories, but also emphasized the process to build student knowledge. In the sense that the five learning courses has been adapted to the demands of the learning process standardization in college. Forms of learning are usually lecture and practicum. The learning method used in the implementation of learning during this time are usually focus group discussions, cooperative learning, group presentations, and administration tasks. The success of the student in the learning process in the subjects of plant morphology, plant anatomy, plant development, basic genetics, and molecular genetics can be seen from learning outcomes obtained.

Referring to the background of the problems outlined in the introduction above, then the problem can be formulated as follows: 1) is there a difference in learning outcomes of biology, between students who have reflective and impulsive cognitive style?; 2) is there any difference in learning outcomes in the subjects of plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics between students have reflective and impulsive cognitive style ?; 3) is there any interaction between the learning outcomes of biology and reflective and impulsive cognitive style?

The purposes of this study are to obtain accurate information on: 1) the learning outcomes of biology between students who have reflective and impulsive cognitive style; 2) the learning outcomes of subjects on plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics between students have reflective and impulsive cognitive style; 3) The interaction between the learning outcomes of biology with reflective and impulsive cognitive style?

The benefits of this research is to increase knowledge in designing the learning model that accommodates differences in cognitive styles of students, especially reflective and impulsive cognitive style.

II. METHODS OF RESEARCH

The types of research that is used, namely a comparative study with the aim to see the differences in learning outcomes of biology, on students who have reflective and impulsive cognitive style. Data learning outcomes of biology are obtained through technique of documentation in the form of test scores for each subject, namely plant morphology, plant anatomy, plant development, basic genetics, and molecular genetics. The technique of documentation is done, because the implementation of the test

for each subject, namely plant morphology, plant anatomy, plant development, basic genetics, and molecular genetics in different semesters. While for collecting of data cognitive style was performed with using technique of test. The instrument is used to measure cognitive style, namely MFFT (Matching Familiar Figures Test) which was designed and developed by [10]. MFFT instrument includes one standard image and 8 variation images. Through this instrument the student is assigned to select one from eight images the same variation with a standard image. The variables were observed, namely time required by students to answer the first time and the frequency of students answered to produce the correct answer.

Research was conducted on student class of 2011 totaling 33 people. Implementation of the research to measure cognitive styles performed at the time of the semester 3. As for the steps to measure cognitive style includes: 1) calling students one by one to completed Test cognitive style through an instrument MFFT by seeking a variation images corresponding to the standard image; 2) record the time used by the student to answer the first question; 3) records the number of answer to obtain correct answers; 4) calculate the amount of time and fekwensi error then divided by the number of items to obtain the average; 5) looking for a median of time (t) and the frequency of (f) and then drawn a line parallel to the axis t and f axis, so that will form four groups of students.

According [10] the four student groups include: 1) a group of students who have characteristics in answering the problem quickly and carefully / thoroughly so the answer are always right; 2) a group of students who have the characteristic slow in answering the problem and carefully / meticulously so that answers are always right (reflective student); 3) a group of students who have characteristics quick in answering but less accurate / less precise that the answers are often wrong (impulsive student); 4) The student group that has the characteristics of slow in answering the problem and less accurate / less precise that the answers are often wrong. In this study is limited to the student reflective and impulsive student only. Furthermore, the data that have been collected will be analyzed using two kinds of statistical techniques, namely descriptive statistics and inferential statistics. Descriptive statistics were used to describe the characteristics of the learning outcomes on subject plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics based reflective cognitive style reflective and impulsive. For the purposes of the median. For inferential statistics using the two-factor ANAVA. Calculations were performed using IBM SPSS Statistics 19 program.

III. RESULTS AND DISCUSSION

A. Result

Measurement of cognitive style using instruments MFFT (Matching Familiar Figures Test) with the observed variables consists of the time required by students to answer the first time and the frequency of students answered to produce the correct answer. Cognitive style is measured at the time the student class of 2011 in semester 3. The author does not do re-measurement of cognitive style, because in theory a person's cognitive style tends to remain. Besides cognitive styles have been used for some research either already published or in the process of publication, such as 1) the critical thinking skills of students who have impulsive and reflective cognitive style in the subjects of basic genetics [14]; 2) a comparison of the ability of students that reflective and impulsive cognitive styles in writing a scientific article as the result of case studies on environmental issues (in the process of being published). The summary of the results of measurements of cognitive style can be seen in Table 1.

Tabel 1. The Summary of the Results of Measurements of Cognitive Style

Class of	Number of Sudent	Time			Frequency			Number of Impulsive Students	Number of reflective Students
		Max	Min	Med	Max	Min	Med		
2011 A	33	73,18	5,68	14,7	4,23	1,62	2,69	11	11

Information: Max: The Maximum Data Med : Median
 Min: The Minimun Data

The results of data analysis using two- factor ANOVA test, to determine the difference in learning outcomes of Biologi between students who have reflective and impulsive cognitive style can be seen in Tabel 2 and 3.

Tabel 2. Descriptive Statistics

Dependent Variable:value				
Subject	Cognitive Style	Mean	Std. Deviation	N
Plant Morphology	Reflective	3.3182	.56003	11
	Impulsive	3.6818	.60302	11
	Total	3.5000	.59761	22
Plant Anatomy	Reflective	3.2727	.46710	11
	Impulsive	3.6818	.40452	11
	Total	3.4773	.47503	22
Basic Genetics	Reflective	2.4091	.94388	11
	Impulsive	2.9091	.91701	11
	Total	2.6591	.94348	22
Plant Development	Reflective	2.8636	.63604	11
	Impulsive	3.0909	.37538	11
	Total	2.9773	.52275	22
Molecular Genetic	Reflective	2.6818	.60302	11
	Impulsive	2.9545	.47194	11
	Total	2.8182	.54654	22
Total	Reflective	2.9091	.72706	55
	Impulsive	3.2636	.66566	55
	Total	3.0864	.71632	110

Tabel 3. Tests of Between Subjects Effects

Dependent Variable: Value

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncen Parameter	Observed Power ^a	
Intercept	Hypothesis	1047.820	1	1047.820	303.117	.037	.997	303.117	.828
	Error	3.457	1	3.457 ^b					
Subject	Hypothesis	12.986	4	3.247	50.123	.001	.980	200.491	1.000
	Error	.259	4	.065 ^c					
Cognitive Style	Hypothesis	3.457	1	3.457	53.368	.002	.930	53.368	.999
	Error	.259	4	.065 ^c					
Subject * Cognitive Style	Hypothesis	.259	4	.065	.165	.956	.007	.660	.084
	Error	39.227	100	.392 ^d					

a. Computed using alpha = .05

b. MS(cognitive Style)

c. MS(Subject* Cognitive Style)

d. MS(Error)

B. Discussion

1. The Measurement Results at the Cognitive Style

Measurement of cognitive style requires two observed variables, namely time and frequency. The time indicate duration the student to answer the first time. Frequency answer indicate number of students answered until a correct answer. Based on Table 1 the maximum time it takes a student is 73, 18 seconds and the minimum time is 5.68 seconds. While the maximum frequency answered was 4.23 and the minimum frequency was 1.62. Limits to classify students as reflective and impulsive, using the median of the time and frequency answer. The results obtained from grouping students who have reflective cognitive style total of 11 people (33.3%) and students who have impulsive cognitive style total of 11 people (33.3%). This indicate that the proportion of students who have reflective and impulsive cognitive style of more than 50%, namely 66,6%. While the rest of 33.4% is the number of students that have the characteristics of fast and precise / accurate in answer or slower and less precise / less accurate in answer. So the sample met the criteria of reflective cognitive style and impulsive total 22 students, with 11 students who have reflective cognitive styles and 11 students who have impulsive cognitive styles. The few studies that have been done proportion of reflective children and impulsive are more than the group of children quickly and carefully and slowly and inaccurate. Research [6] found the proportion of reflective children and impulsive were 76.2%, as well as research that has been done [9] that the proportion of the characteristics of reflective-impulsive were 73.8%.

2. Learning Outcomes of Each Subject

Based on Table 3 shows that F count to the learning outcomes for each subject is 50 123 with a probability of 0.001. Because the probability of <0.05 , then the learning outcomes on plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics indicate a difference. Because there are significant differences then to see the learning outcomes the most good, seen from the total mean for each subject as shown in Table 2. Based on the results of descriptive statistical analysis are presented in Table 2 shows the total mean to subject plant morphology highest value, the second order plant anatomy, then plants development, molecular genetics, and the final sequence is a genetic basis. Results of study on plant morphology showed the most good, this is because that the material of plant morphology included in the factual and conceptual knowledge. Based on the revised Bloom's taxonomy, that is the factual knowledge, the knowledge base must be known to the student so that the student is able to understand a problem or solve the problem. While the definition of conceptual knowledge, namely a basic knowledge which interconnected and with a larger structure so that it can be used together. While on the basis of genetics the characteristics of the material is procedural knowledge, namely the knowledge of how to do things, methods to search for something, the knowledge that favor ability, algorithms, techniques, and Methods [13].

3. Learning Outcomes of Biology Between Students have a Reflective and Impulsive Cognitive Style

Based on Table 3 shows that F count for learning outcomes of biology between students who have a reflective and impulsive cognitive style is 53 368 with a probability of 0.002. Because the probability of <0.05 , so there are differences in the learning outcomes of biology between students who have a reflective and impulsive cognitive style. Based on these differences, where between the students who have a reflective and impulsive cognitive style, which better learning outcomes of biology. Based to Table 2 shows that the mean learning outcomes of biology for student who have a impulsive cognitive style was higher than students who have a reflective cognitive style. This is consistent with the theory that the impulsive cognitive styles have a positive relationship with learning outcomes [9], because of the characteristics of the five subjects generally be factual and conceptual. The results of this study are different with studies on the matter of a procedural nature such as in mathematics associated with critical thinking skills, students who have a reflective cognitive style superior to the impulsive [16]. While research of [15] showed no difference in the learning outcomes of mathematics between students who have a reflective and impulsive cognitive style. Furthermore, based on Table 3 shows that, F count for the interaction between the learning outcomes with reflective and impulsive cognitive style are 303 117 with a probability of 0.037. Because the probability of <0.05 , so there are an interaction between the learning outcomes with cognitive style (Reflective and impulsive). This means that the learning outcomes to plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics influenced by cognitive styles of students (reflective and impulsive).

IV. CONCLUSION AND SUGGESTION

Conclusion

Based on the results of the research that have been described, it can be concluded as follows: 1) There are differences in learning outcomes on plant morphology, plant anatomy, plant growth, basic genetics, and molecular genetics. Of the five subjects, the learning outcomes of students are most excellent, namely in plant morphology; 2) There are difference in learning outcomes of biology between students who have reflective with impulsive cognitive style. Students who have impulsive cognitive styles, the learning outcomes of biology are better than the reflective cognitive styles; 3) There are interaction between the learning outcomes of biology and cognitive style (reflective and impulsive cognitive style). This means that the learning outcomes of students in biology affects cognitive style.

Suggestion

Based on the conclusions that have been put forward, it is advisable to research information about reflective and impulsive cognitive styles can be used as consideration, for lecturers in choosing models, approaches and methods suitable for learning.

ACKNOWLEDGMENT

This opportunity authors would like to thank the university PGRI Ronggolawe Tuban, which has given permission to conduct research on student class of 2011 on the analysis learning outcomes of biology based on reflective cognitive style and impulsive.

REFERENCES

- [1] Acharya, M.C. 2002. Students' Learning Style and Their Implication for Teacher. *Centre for Development of Teaching and Learning*. Vol.5 (6):1-3.
- [2] Froehlich. 2003. Cognitive Style: A Review of The Major Theories and Their Application to Information Seeking in Virtual Environments.
- [3] Kagan, J. And Kogan, N. 1970. *Individual Variation in Cognitive Processes*. Dalam Mussen, P (Ed.) Carmichael's Manual of Child Psychology (3rd ed. Vol.1), New York: Wiley.
- [4] Liu, Y. And Ginther, D. 1999. Cognitive Style and Distance Education Online *Journal of Distance Learning Administration*. Vol. II (III).
- [5] Peraturan Menteri Riset, Teknologi, dan Pendidikan Tinggi Republik Indonesia Nomor 44 Tahun 2015 tentang Standar Nasional Pendidikan Tinggi.
- [6] Rozenwajg, P. and Corroyer, D. 2005. Cognitive Processes in The Reflective-Impulsive Cognitive Style. *The Journal of Genetic Psychology*. Vol.166(4):451-463.
- [7] Rustaman, N.Y. 2011. *Membangun Literasi Sains Peserta Didik*. Bandung: Humaniora.
- [8] Slameto. 2013. *Belajar dan Faktor-Faktor yang mempengaruhi*. Jakarta: Rineka Cipta.
- [9] Warli. 2009. Pembelajaran Kooperatif Berbasis gaya kognitif reflektif-Impulsif (Studi Pendahuluan Pengembangan model KBR-1). *Seminar Nasional Penelitian Pendidikan dan Penerapan MIPA*. 6 Mei 2009. Yogyakarta. Indonesia. Hal.567-574.
- [10] Warli. 2010. Kemampuan Matematika Anak Reflektif dan Impulsif. *Seminar Nasional Matematika dan Pendidikan matematika*. 30 Januari 2010. Malang. Indonesia. Hal.590-603.
- [11] Winkel, W.S. 2007. *Psikologi Pengajaran*. Jakarta: PT.Grasindo Persada.
- [12] Winkel, W.S. 1996. *Psikologi Pengajaran*. Jakarta: Gramedia Widiasarana Indonesia
- [13] Rochmad, 2012. Revisi Taksonomi Bloom (A Revision Of Bloom's Taxonomy). (On line). <https://imamprasaja.files.wordpress.com/2013/06/rochmad-bloom-ori.pdf>. Diakses 21-April 2016.
- [14] Cintamulya. 2014. Kemampuan Berikir Kritis Mahasiswa yang Bergaya Kognitif Impulsif dan Mahasiswa Bergaya Kognitif Reflektif. *Seminar dan Workshop Nasional Biologi/IPA dan Pembelajarannya*. Universitas Negeri Malang 12 November 2014. Malang. Indonesia. Hal 289-296.
- [15] Rahman. 2008. Analisis Hasil Belajar Matematika Berdasarkan Perbedaan Gaya Kognitif secara Fisiologis dan Konseptual Tempo pada Siswa Kelas X SMAN 3 Makasar. *Jurnal Pendidikan dan Kebudayaan*. Vol. 14(072):452-473.
- [16] Ningsih, P.R. 2012. Profil Berpikir Kritis Siswa SMP dalam Menyelesaikan Masalah Matematika Berdasarkan Gaya Kognitif. *Gramatika*. Vol. II (2):120-127.