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Elementary School Teachers' Opinion About Learning Continuum of Organism Diversity Aspect Based on Level of Cognitive Processes

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ABSTRACT
This study aims to determine the teachers' opinion who teach science in elementary schools regarding the continuum of learning design on organisms diversity aspect. The method used in this research was a survey by giving a questionnaire to the teacher. The study population in this study was a hypothetical population with convenience samples. The number of samples used was as many 156 teachers in Bantul district and Yogyakarta city. The results showed that the teacher believed that the diversity aspects of organisms taught starting in classes V and VI Elementary School (ES) with the cognitive process level or competency level (CL) were "remembering" (C1) and "understanding" (C2). The cognitive level of "remembering" (C1) is taught in classes V and VI of elementary school, while the cognitive level of "understanding" (C2) is taught starting from classes V and VI of elementary school (ES), class VIII of junior high school (JHS), and class X of senior high school (SHS).

Keywords: *Learning Continuum, Level of Cognitive Processes, Organisms Diversity Aspect, Teachers' Opinion.*

1. INTRODUCTION

Curriculum improvement is one way to achieve quality education [1]. A good curriculum should present the scope of teaching material based on the level of cognitive processes of students. Based on the analysis of the decree of the National Education Minister No. 37 of 2018, the competence and scope of the material have not been compiled in an integrated and sequential manner from each level of education based on the level of cognitive processes of students [2]. In the 2013 curriculum, the competency levels have not been arranged sequentially, meaning that existing competencies have not been compiled based on the learning continuum [3] [4]. To ensure continuity between levels of education, a standard learning material is required to be delivered to students in each class. This learning continuum standard is developed from primary to secondary education. Therefore, references are needed to develop blueprints in the form of a learning continuum, from the simplest to the most complex and from the easy to the difficult [5].

The learning continuum is a logical sequence that shows the vertical relationship between materials [6]. Knowledge of the learning continuum is built on the level of complexity of the teaching material from one simple level to a more complex one. Previous knowledge can be used as a background that can help students learn at the next level. The Northwest Evaluation Association's role learning continuum can be used as an example of curriculum development or curriculum improvement programs [7].

The level of cognitive processes and teaching materials must be by the mental development of students so that the scientific concepts are continuous with the knowledge students acquire at every level of education [8]. In Bruner's opinion, the higher the level, the more complex the material being studied [9] [10]. Piaget's theory explains that the development of students has four levels; motor-sensory, pre-operational, concrete operational, and formal operation. Each stage has different characteristics of cognitive development. Elementary school students enter the formal operational level who can think rationally, even though they are

limited to concrete forms. The thinking of high school level students has grown more complex. According to this theory, the development of students' thinking develops through certain stages according to age-related mental development and levels of cognitive processes [8].

According to Anderson and Kratwohl (2001), the level of cognitive processes starts from simple (remembering) to more complex (creating) [11]. The use of Bloom's taxonomy is useful in encourage teachers to think about learning objectives. Consider the need for cognitive skill levels leading to knowledge transfer for multiple contexts [27]. This is in accordance with the spiral curriculum adopted by Indonesia, namely the higher the level of education, the teaching materials will be more complex [8]. Because the basic competencies of teaching materials still overlap, the grid of teaching materials in basic education is needed as a guide in curriculum development.

The formulation of a teaching material grading grid needs to ask the teachers' opinions. This is because the teacher has the empirical experience that knows the mental and cognitive development of students. Curriculum development by paying attention to material content at each level of education can make the learning process more effective [12].

Two studies on the learning continuum have shown a low mode of attainment [13] [14]. It is suspected that there are factors that cause the research to produce a low mode so that this study will be explored in more detail based on the aspects of the level of cognitive processes.

This research involves the role of the teacher in making the learning continuum grid. The results are expected to be used as a consideration for the government to improve the curriculum. Teachers should not only act as curriculum implementers, but also as curriculum developers [28]. Caswell stated that teachers must play an active role in the curriculum writing process [15]. Curriculum creation can be a way to help teachers connect the content of materials according to student needs [16]. They know the advancement of science that is taught directly to students and have special knowledge from teaching experience with professional teaching development [29].

2. METHODS

This type of research is a descriptive study with a survey method. The research objective was to ask the elementary school science teacher's opinion regarding the separation of biology teaching materials based on the level of cognitive processes. Population and sampling in this study followed Daniel's terminology [17], namely a hypothetical population with convenience samples. A convenience sample is a type of non-probability sampling method where the sample is taken from a group of people easy to contact or to reach. The population in this study were all elementary school science teachers in Special Region of Yogyakarta Province. The research samples were 156 elementary school teachers in Bantul district and Yogyakarta city.

The instrument in this study was a validated questionnaire with a confirmatory assessment model based on the level of cognitive processes regarding the characteristics of the content of biological aspects. Especially the diversity aspect of organisms.

The data analysis technique in this research used descriptive analysis techniques. The data that has been obtained are described with actual results without any manipulation. The purpose of the descriptive analysis is to compile the practitioner's opinion about the ranking of teaching materials based on the level of cognitive processes by the characteristics of the biology aspects targeted at students in elementary school.

3. RESULT AND DISCUSSION

Data on the opinion of elementary school teachers who teach science about the learning continuum from the aspect of the diversity of organisms were obtained from 156 respondents. In this study, the biology aspects were divided into 13 sub-aspects, namely: 1) Biome diversity, 2) ecosystem diversity, 3) community diversity, 4) interpopulation diversity, 5) individual diversity in population, 6) diversity of organ systems human and animal bodies 7) Diversity of body organs of organisms, 8) Diversity of tissues in organisms, 9) Diversity of cells in organisms, 10) Diversity of molecules in organisms, 11) Diversity of genes, and 12) Biodiversity of Indonesia. These sub-aspects are further divided into several study topics for more detail and clarity. In addition, this sub-aspect is seen in terms of similarities and differences.

Table 1. Percentage of opinions' science teachers about learning continuum of organism diversity aspects with sub-aspects from 1 to 5

The aspects of organism diversity	The opinions' science teachers (N^a = 156)	
	Modus	**Cls[b]/CL[c]**
Sub-aspect 1: Biome diversity, similarities and differences		
a. Biome diversity (desert, forest, steppe, savanna, taiga, tundra, etc.), similarities and differences	23%	V/C2[d]
b. Factors that influence biodiversity (desert, forest, steppe, savanna, taiga, tundra, etc.).	18%	V/C2
Sub-aspect 2: Ecosystem diversity, similarities and differences		
a. Terrestrial ecosystem diversity, similarities and differences	20%	V/C2
b. Diversity of aquatic ecosystems, similarities and differences	19%	V/C2
c. Factors affecting ecosystem diversity (land and water)	19%	V/C2
Sub-aspect 3: Community diversity, similarities and differences		
a. Diversity of animal/plant/fungal/protist/monera/bacteria communities in an ecosystem, their similarities, and differences	34%	V/C2
b. Factors affecting community diversity, similarities and differences	29%	V/C2
Sub-aspect 4: Diversity between populations, similarities and differences		
a. Diversity of human populations, animals, plants, fungi, protists, monera, bacteria; similarities and differences	37%	VI/C2
b. Factors affecting species/population diversity, similarities and differences	29%	VI/C2
Sub-aspect 5: Diversity of individuals in the population, similarities and differences		
a. The diversity of individuals in human populations, animals, plants, fungi, protists, monera, bacteria; similarities, and differences	29%	VI/C2
b. Factors affecting individual diversity in human populations, animals, plants, fungi, protists, monera, bacteria	24%	VI/C2

Table 1 shows that based on the opinion of science teachers in elementary schools, there are no cognitive process levels C1 (remembering), C3 (applying), C4 (analyzing), C5 (evaluating), and C6 (creating) taught in elementary schools. According to the teachers, the five sub-aspects above are taught at the C2 cognitive process level (understanding). The first to third sub aspects are taught in class V, while the fourth and fifth sub aspects are taught in class VI. The fourth and fifth sub-aspects taught in class VI indicate a different depth of material compared to the previous sub-aspects so that this sub-aspect cannot be provided in class V. Continuous learning, namely competencies or concepts that must be taught by the teacher continuously and compiled from simple to the complex according to the development of learners [5] [18].

Table 2. Percentage of opinions' science teachers about learning continuum of organisms diversity aspects with sub-aspects from 6 to 11

The aspects of organisms diversity	The opinions' science teachers (N^a = 156)	
	Modus	**Cls[b]/CL[c]**
Sub-aspect 6: Diversity of the organ systems making up the human body and animal, similarities and differences		
a. Diversity of organ systems making up the human body and animals, their similarities and differences	32%	V/C1[d]
b. Factors affecting the diversity of organ systems making up the human body and animals	24%	V/C1
Sub-aspect 7: Diversity of organisms in organisms, similarities. and differences		
a. Diversity of the constituent organs of the body of an organism (humans, animals, plants, fungi, protists, monera, bacteria); similarities, and differences	31%	VI/C1
b. Factors that affect the diversity of the organs making up the organism	23%	VI/C1
Sub-aspect 8: Diversity of tissues in the body of an organism, similarities, and differences		
a. Tissue diversity in the body of organisms (humans, animals, plants, fungi, protists, monera, bacteria); similarities and differences	28%	VIII/C2
b. Factors that influence the diversity of the body's constituent tissues of organisms	29%	VIII/C2
Sub-aspect 9: Diversity of cells in the body of an organism, their similarities, and differences		
a. Cell diversity in the body of organisms (humans, animals, plants, fungi, protists, monera, bacteria); similarities and differences	31%	VIII/C2
b. Factors that affect the diversity of cells making up the organism's body	31%	VIII/C2
Sub-aspect 10: Diversity of molecules in the body of an organism, their similarities and differences		
a. Molecular diversity in the body of an organism; similarities and differences	33%	X/C2
b. Factors affecting the molecular diversity of organisms	33%	X/C2
Sub-aspect 11: Gene diversity, similarities and differences		
a. Diversity of human genes, animals, plants, fungi, protists, monera, bacteria; similarities and differences	33%	X/C2
b. Factors affecting gene diversity, similarities and differences	33%	X/C2

[a]total respondent [b]class [c]competency level (cognitive scope)
[d]remembering

Table 2 shows that based on the opinion of science teachers in elementary schools, the fifth and sixth sub-aspects cannot be taught with a cognitive process level above C1 (remembering). This is most likely because the material is quite abstract with a high enough level of difficulty for elementary students. However, students' thinking abilities are according to the level of age development. Elementary school students have a different way of thinking from junior high schools or high schools [25]. As we can see, the learning material on these sub aspects is quite heavy and makes it difficult for students to accept it. Similar to sub-aspects 8, 9, 10, and 11, the teacher argues that these sub-aspects are not taught at the elementary school level. This is because the observed diversity cannot be grasped by the senses [18]. Abstract concepts make students only able to imagine without seeing real objects. The dense study of teaching materials can also cause learning difficulties for students [26].

Sub-aspects of the diversity of organ systems that make up the human and animal bodies are taught in class V and sub-aspects of the diversity of organs are taught in class VI. In the sub-aspects that are not taught in elementary schools, respondents gave their opinion to teach at the junior high school (JHS) and senior high school (SHS) levels.

The sequence of concepts from easy to difficult which is adjusted to student development will make it easier for students to build their knowledge. According to Piaget, students aged 7-11 years or elementary school students tend to level of thinking towards real objects, while students aged 11 years and over begin to be able to learn abstract objects [19]. In other words, complex and complex concepts are more suitable to be taught at the junior and senior high school levels. Knowles argues that students learn from simple (easy) concepts in childhood to more complex (difficult) concepts in adolescence and adulthood [20]. Therefore, learning materials should be continuous between school levels, so that learning can be more effective and efficient. The multilevel concept will help students to further deepen the material they have learned at the previous educational level. Also, it can be a foundation or prior knowledge that will support students to learn the next more subtle, abstract, and complex concepts.

Based on Table 3, we know that Indonesia's

Table 3. Percentage of opinions' science teachers about learning continuum of organisms diversity aspects with sub-aspects from 12

The aspects of organisms diversity	The opinions' science teachers (N^a = 156)	
	Modus	**Cls[b]/CL[c]**
Sub-aspect 12: Indonesia's biodiversity, similarities and differences		
a. Indonesian flora diversity, similarities and differences		
1) The diversity of flora in the oriental zone (western Indonesia), similarities and differences	26%	V/C1[d]
2) The diversity of the fauna of the Australis zone (eastern Indonesia), similarities and differences	23%	V/C1
3) The diversity of flora of the transition zone (central Indonesia), their similarities and differences	21%	V/C1
4) Rare flora types, similarities and differences	18%	V/C2[e]
5) Endemic flora types, similarities and differences	18%	V/C2
b. Indonesian fauna diversity, similarities and differences		
1) Zone fauna diversity oriental (western Indonesia), its similarities and differences	22%	VI/C2
2) The diversity of the fauna of the Australis zone (eastern Indonesia), their similarities and differences	24%	V/C1
3) Transitional zone fauna diversity (central Indonesia), similarities and differences	22%	V/C1
4) Rare fauna types, similarities and differences	19%	V/C2
5) Endemic fauna types, their similarities and differences	19%	V/C1
c. The diversity of species of specific micro-organisms in Indonesia, their similarities and differences	45%	VI/C1
d. Ecosystem diversity in Indonesia, similarities and differences	21%	VI/C2

[a]total respondent [b]class [c]competency level (cognitive scope)
[d]remembering

biodiversity according to science teachers in elementary schools is taught in grades 5 and 6, with cognitive process levels C1 and C2. The level of cognitive processes and teaching materials must be in accordance with the mental development of students so that the scientific concepts are continuous with the knowledge that students acquire at every level of education [8]. In other words, students' cognitive development is also very much needed to be taken into consideration for preparing pedagogic material and competency levels that refer to the theory of cognitive development by Piaget [21].

After obtaining the percentage of science teacher's opinion on the aspect of organism diversity aspect, a learning continuum sequence is obtained based on the level of cognitive processes presented in Table 4 below.

Table 4. Learning continuum of the organisms diversity aspects

Level of cognitive processes	The aspects of organisms diversity	Modus (%)	Class/ Grade
C1 (remembering)	**Sub-aspect 6: Diversity of the organ systems making up the human body and animal, similarities and differences**		
	c. Diversity of organ systems making up the human body and animals, their similarities and differences	32%	V/ES[a]
	d. Factors affecting the diversity of organ systems making up the human body and animals	24%	V/ES
	Sub-aspect 7: Diversity of organisms in organisms, similarities and differences		
	c. Diversity of the constituent organs of the body of an organism (humans, animals, plants, fungi, protists, monera, bacteria); similarities and differences	31%	VI/ES
	d. Factors that affect the diversity of the organs making up the organism	23%	VI/ES
	Sub-aspect 12: Indonesia's biodiversity, similarities and differences		
	a. Indonesian flora diversity, similarities and differences		
	1) The diversity of flora in the oriental zone (western Indonesia), similarities and differences	26%	V/ES
	2) The diversity of the fauna of the Australis zone (eastern Indonesia), similarities and differences	23%	V/ES
	3) The diversity of flora of the transition zone (central Indonesia), their similarities and differences	21%	V/ES
	b. Indonesian fauna diversity, similarities and differences		
	2) The diversity of the fauna of the Australis zone (eastern Indonesia), their similarities and differences	24%	V/ES
	3) Transitional zone fauna diversity (central Indonesia), similarities and differences	22%	V/ES
	5) Endemic fauna types, their similarities and differences	19%	V/ES
	c. The diversity of species of specific micro-organisms in Indonesia, their similarities and differences	45%	VI/ES
C2 (Understanding)	**Sub-aspect 1: Biome diversity, similarities and differences**		
	a. Biome diversity (desert, forest, steppe, savanna, taiga, tundra, etc.), similarities and differences	23%	V/ES
	b. Factors that influence biodiversity (desert, forest, steppe, savanna, taiga, tundra, etc.).	18%	V/ES
	Sub-aspect 2: Ecosystem diversity, similarities and differences		
	a. Terrestrial ecosystem diversity, similarities and differences	20%	V/ES
	b. Diversity of aquatic ecosystems, similarities and differences	19%	V/ES
	c. Factors affecting ecosystem diversity (land and water)	19%	V/ES
	Sub-aspect 3: Community diversity, similarities and differences		
	a. Factors affecting community diversity, similarities and differences	29%	V/ES
	b. Diversity of animal / plant / fungal / protist / monera / bacterial communities in a ecosystems, their similarities and differences	34%	V/ES
	Sub-aspect 4: Diversity between populations, similarities and differences		
	a. Diversity of human populations, animals, plants, fungi, protists, monera, bacteria; similarities and differences	37%	VI/ES
	b. Factors affecting species / population diversity, similarities and differences	29%	VI/ES
	Sub-aspect 5: Diversity of individuals in the population, similarities and differences		
	a. The diversity of individuals in human populations, animals, plants, fungi, protists, monera, bacteria; similarities and differences	29%	VI/ES
	b. Factors affecting individual diversity in human populations, animals, plants, fungi, protists, monera, bacteria	24%	VI/ES
	Sub-aspect 12: Indonesia's biodiversity, similarities and differences		
	a. Indonesian flora diversity, similarities and differences		
	4) Rare flora types, similarities and differences	18%	V/ES
	5) Endemic flora types, similarities and differences	18%	V/ES
	b. Indonesian fauna diversity, similarities and differences		
	1) Zone fauna diversity oriental (western Indonesia), its similarities and differences	22%	VI/ES
	4) Rare fauna types, similarities and differences	19%	V/ES

Level of cognitive processes	The aspects of organisms diversity	Modus (%)	Class/ Grade
C2 (Understanding)	**d. Ecosystem diversity in Indonesia, similarities and differences**	21%	VI/ES
	Sub-aspect 8: Diversity of tissues in the body of an organism, similarities and differences		
	a. Tissue diversity in the body of organisms (humans, animals, plants, fungi, protists, monera, bacteria); similarities and differences	28%	VIII/JHS[b]
	b. Factors that influence the diversity of the body's constituent tissues of organisms	29%	VIII/JHS
	Sub-aspect 9: Diversity of cells in the body of an organism, their similarities and differences		
	a. Cell diversity in the body of organisms (humans, animals, plants, fungi, protists, monera, bacteria); similarities and differences	31%	VIII/JHS
	b. Factors that affect the diversity of cells making up the organism's body	31%	VIII/JHS
	Sub-aspect 10: Diversity of molecules in the body of an organism, their similarities and differences		
	a. Molecular diversity in the body of an organism; similarities and differences	33%	X/JHS
	b. Factors affecting molecular diversity of organisms	33%	X/SHS[c]
	Sub-aspect 11: Gene diversity, similarities and differences		
	a. Diversity of human genes, animals, plants, fungi, protists, monera, bacteria; similarities and differences	33%	X/SHS
	b. Factors affecting gene diversity, similarities and differences	33%	X/SHS

[a]ES: Elementary School [b]JHS: Junior High School [c]SHS: Senior High School

The order of the level of cognitive processes in the sub-aspects of organism diversity aspect, namely, C1 (remembering) in classes V and VI, and C2 (understanding) for classes V, VI, VIII, and X are very logical when compared to children's mental development for receive the materials. Like the research conducted by Mendala (2019) which states that the biology material in ecological aspects according to tehe opinion of biology education experts begins to be taught in classes IV, V, VII to X [14].

The sequence of material that is sustainable in accordance with student development like this will make the learning process run well [22]. Initial skills provide the necessary background knowledge to begin learning skills at a higher level [23]. Curriculum development must show the relationship between teaching materials at every level of education, from low to high levels. Teaching material that has been taught at a lower level of education should not be taught at a higher level of education to avoid overlapping of the teaching material in the learning process [24]. At a higher level of education, the teaching material provided to student in the scope of the study being studied is broader and deeper.

The learning continuum is useful as a guideline for determining differences in student achievement levels. In addition, the learning continuum can help teachers identify student weaknesses in learning. Also, teachers can help students build their knowledge in mastering competences [22].

4. CONCLUSION

Based on the research results, it can be concluded that the learning continuum, according to the opinion of science teachers in elementary schools, still overlaps. Science teachers in elementary schools believe that special pedagogical material from the aspect of diversity of organisms should be taught starting from grades V and VI at the level of competence to remember (C1) and understand (C2). There are also some aspects of the diversity of organisms that should not be taught in primary schools. Therefore, the sub aspects that are not taught in primary schools will be taught in junior and senior high schools. So that sequential learning material is formed from the elementary school level to the secondary level. This teacher's opinion is needed by the government in making future policies. The teacher's opinion is needed for curriculum development, so that the sequence of pedagogical materials from the aspect of the diversity of organisms becomes more specific and the level of competence is in accordance with the cognitive development of students.

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