

The Learning Continuum of Biological Resource Management Aspects Reviewed From the Difficulty Levels Based on Elementary School Teachers' Opinions

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ABSTRACT

This research aims to investigate teachers' opinion on the teaching and assessment of biological resource management aspects reviewed from their difficulty level in order to develop a curriculum. This is survey research whose sample members were selected through the convenience sampling technique. In this study, the convenience sample covers 156 respondents as the representatives of the hypothetical population having the determined characteristics. They consisted of elementary school teachers of grade I to VI in two regencies/cities in the Special Region of Yogyakarta, namely Yogyakarta municipality and Bantul regency. Data were collected by means of questionnaires and analyzed by using descriptive analysis techniques. Based on the findings of this study, elementary school teachers would opine that the aspects of biological resource management are at level 2 (*easy*) and level 3 (*somewhat difficult*). These aspects are proposed to be taught and assessed in grade IV and VI of elementary schools and grade VII of junior high schools.

Keywords: *Learning Continuum, Biological resource management, difficulty level, elementary school.*

1. INTRODUCTION

The Indonesian government has released a new curriculum in 2013, namely the 2013 curriculum (K13). The curriculum implemented in Indonesia should be formulated based on the level of students' development [1]. The learning process should be appropriate for the students' development in each level of education, so that students can master sustainable competencies [2]. Likewise, the implementation of the learning process should be able to support the educational goals to be achieved [3]. A curriculum has some main components including the competences that will be achieved and teaching materials that will be studied in the learning process [4].

Learning materials are the contents of the learning activities striven to be mastered by students [5]. In fact, the existing teaching materials have not met the needs of students [6]. The materials taught in the learning process are still overlapping and incompatible with the

development of learners [7]. Determination of basic competencies, therefore, should pay attention to the depth of the materials so that the contents presented in the textbooks can be the main sources of learning that guide students to achieve their target competences. Ideally, the content knowledge provided in the learning materials should be managed in some levels of difficulty (easy to difficult), from elementary schools (ESs) to senior high schools (SHSs). For example, the learning materials introduced in ESs are basic and easy, and they are continued to be explored in JHSs while holding the characteristics of the simplicity of delivery. Then, the learning materials are further strengthened and elaborated at the SHS level. A strong foundation in primary sciences is a prerequisite for whatever sciences to be taught at the other levels [8].

In addition, the implementation of the curriculum should be assessed periodically [9]. The learning process may not be effective if the development of the curriculum does not continuously pay attention to the

essence of sustainable materials in every level of education [1]. Therefore, the reference for the formulation of a framework in the form of a functional learning continuum as a learning target is needed [10].

Learning continuum gives many benefits in the learning process as it functions as a basis in selecting the learning materials and sources which are suitable with the learners, and it can be used by teachers to develop individuals' learning and lesson plans, and it is the core principle to compose, fix, and develop the curriculum [11],[12],[13].

In addition, learning continuum should start to be considered and arranged to support the process of achieving learning objectives. The process of preparing a continuous learning must be able to reflect the scientific construct that is sequential according to the development of students [1]. The scope of the learning materials in continuous learning in the conceptual knowledge is formulated based on the characteristics of the learners so that learning becomes more focused and more suitable with the ability of the learners [14]. Learning continuum, in other words, can be developed based on the teachers' opinions because they directly deal with students [4].

With regard to the research context, Biology has diverse topics that are taught to students, including the aspects of morphology of living things, anatomy of living creatures, physiology of living things, diversity of living things, management of biological resources, classifications of living things, ecological, genetics, evolution, and the physical and chemical topics[15]. Regarding this, the biological resource management is an important aspect to be taught to students. Giving this aspect to students is expected to increase their concern for nature and to be wiser in exploiting nature. The assessment of the materials contained in this aspect hence becomes necessary to be carried out so that every material provided is in accordance with the development of the students.

The learning continuum regarding aspects of biological resource management has been reported by Kusumawati et al. (2019) [3]. Kusumawati et al. (2019) reported the learning continuum on aspects of biological resource management was formed based on the level of competence and the characteristics of specific pedagogical material with the respondents were consisted of biological education experts. The findings showed that this aspect has been taught in the seventh grade junior high school with cognitive level C2 (*understanding*) and in the tenth grade senior high school with cognitive level C3 (*applying*). Based on the findings of research conducted by Kusumawati et al. (2019), aspects of biological resource management have not been taught at the elementary school, if seen from the characteristics of the material, this aspect should have been taught starting from the elementary level. Based on this rationale, the researchers were interested in conducting a research study to reveal the difficulty levels of content knowledge or teaching materials to

arrange a learning continuum framework for aspects of the biological resource management based on the opinions of thematic teachers. The findings are expected to contribute to the development of the more appropriate curriculum in elementary schools.

2. METHOD

This is descriptive research harnessing a survey method to investigate the opinions of some ES teachers on the teaching and the assessment of biological resource management aspects in their school. This study was conducted in two regencies/cities in the Special Region of Yogyakarta province, from March to May 2020. The selected areas were Bantul regency and Yogyakarta municipality. This location selection was carried out to obtain different sample characteristics, the samples or respondents who taught at two places with different regional characteristics, they were regency and municipality/city, so that the data obtained was more comprehensive. Daniel's (1989) principles for determining the research population and sample were employed. Meanwhile, the sample members were chosen by the convenience sampling technique, i.e. those who are easy to find [16]. The hypothetical population in this research includes teachers in Public Elementary Schools(ESs) in the Special Region of Yogyakarta. The convenience sample members consist of 156 respondents as representatives of the hypothetical population who had the sample characteristics. The 156 participating teachers taught students from grade I to VI in the respective regencies. There were 14 public ESs in Bantul regency and 12 public ESs in Yogyakarta municipality. The participating teachers in grade I to VI consists of 26 respondents for each grade. Whilst the variable investigated in this study was the presentation of the sequence of the specific pedagogical material in the biological natural resource management aspect, based on their difficulty level.

The data were collected by using questionnaires, a non-test instrument, distributed to the respondents (teachers). The questionnaire had been previously validated by an instrument expert in February 2020. Aspects of biological resource management are presented in the questionnaire that consists of five sub-aspects. They include kinds of biological natural resources, conservation efforts of biological natural resources, the benefits of biological natural resources, the balance of nature, and the nature conservation. While the difficulty levels are depicted in the five-point scales (1) "*very easy*", (2) "*easy*", (3) "*somewhat difficult*", (4) "*difficult*", (5) "*very difficult*".

Data were analyzed by using a descriptive analysis technique which served the mode of respondents' opinions obtained from the questionnaires. The mode shows the agreement between respondents (ES teachers) and it can be seen when the aspects or sub-aspects are mostly taught and how their difficulty levels are so they

can be appropriately arranged in the learning continuum of the biological resource management aspects.

3. RESULT AND DISCUSSION

The opinions about the biological resource management aspects that should be taught at school were obtained

from 156 thematic teachers from Public Elementary Schools in two regencies in the Special Region of Yogyakarta. The data on the difficulty levels of the biological resource management aspects are summarized in Table 1.

Table 1. The percentages of the opinions of ES teachers regarding the level of difficulty of the biological resource management aspects

Difficulty levels	Biological Resource Management Aspects	Mode	Grade	Logical/ Illogical
Level 1 (Very Easy)	-	-	-	
Level 2 (easy)	Sub aspects: Kinds of biological natural resources			
	a. Plant	52%	IV	Logical
	b. Agricultur and Plantation	51%	IV	Logical
	c. Animal, Livestock and fishery	52%	IV	Logical
	Sub aspects: Conservation efforts of biological resources			
	a. In-situ maintenance			
	1) Wildlife sanctuary	51%	IV dan VI	Illogical, only taught in IV
	2) National park	52%	IV	Logical
	3) Nature preserve	50%	IV	Logical
	4) Sea park	50%	IV dan VI	Illogical, only taught in IV
	b. Ex-situ maintenance			
	1) Botanical garden	52%	IV	Logical
	2) Zoo	52%	IV	Logical
	3) Forest park botanical garden	52%	IV	Logical
	c. Conservation efforts of biological resources artificially	45%	VI	Logical
	d. Conservation efforts of biological resources naturally	53%	VI	Logical
	Sub aspect: The benefit of biological resources			
	a. The benefit in the environmental field	53%	IV	Logical
	b. The benefit of biology	54%	IV	Logical
	c. The benefit of economic field	50%	IV dan VI	Illogical, only taught in IV
Sub aspects: The balance of nature				
a. The harmony of nature	51%	VI	logical	
Level 3 (Somewhat Difficult)	b. The conservation and presevation	44%	VI	Illogical, replaced VII
	Sub aspects: The nature conservation			
	a. The conservation with general purposes			
	1) The tight conservation	43%	VII	Logical
	2) The guide conservation	41%	VI	Illogical, replaced VII
	b. The conservation with certain purposes			
	1) Geological protection	32%	VI	Illogical, replaced VII
	2) Anthropology protection	33%	VI	Illogical, replaced VII
	3) Botany conservation	32%	VI	Illogical, replaced VII
4) Zoology conservation	33%	VI	Illogical, replaced VII	
Level 4 (Difficult)	-	-	-	
Level 5 (Very Difficult)	-	-	-	

Table 1 shows that the ES teachers' views regarding the level of difficulty of the biological resource management aspects. It is apparent that several sub-aspects, such as kinds of biological natural resources, conservation efforts of biological resources and the benefit of biological resources have the same level of difficulty, which is at level 2 (*easy*). This means that according to the teacher's opinions, these sub-aspects' characteristics and scope are easy. Several other sub-aspects, such as the balance of nature and the nature conservation are at level 3 (*somewhat difficult*). Based on Subali & Suyata, if the sub-aspects that are easy are learned, they can be taught for students at the beginning level [17]. Piaget argues that each stage of child development has different characteristics of cognitive development, such as the sensory-motor (0-1.5 years), pre-operational (1.5-6 years), concrete operational (6-12 years), and the formal stage (12 years and over) [18]. While generally, students at the elementary school level in Indonesia are at the age of 6-12.

Furthermore, from Table 1 it can be seen that several sub-aspects of the biological resource management, such as kinds of biological natural resources, conservation efforts of biological resources and the benefit of biological resources begin to be taught and assessed in grade IV of ESs. Several indicators, including indicator (a) about in-situ maintenance (wildlife sanctuary and sea park) in the sub-aspect of conservation efforts of biological resources, and indicator (c) about the benefit of the economic field in the sub-aspect of the benefit of biological resources, will continue to be taught in the sixth grade of elementary schools. The choice of grade level of teachers' opinions is illogical, and it will be better if these indicators are taught in the fourth grade only. Thus, there is no need to be taught again in the sixth grade. This is in line with the idea, that any learning materials should not be taught in higher levels of education if they have been taught in the previous level [3]. Several other indicators in the sub-aspect of conservation efforts of biological resources, including indicator (c) Conservation efforts of biological resources artificially, and (d) Conservation efforts of biological resources naturally are started to be taught and assessed in the sixth grade of elementary school.

According to Table 1, The sub-aspect of the balance of nature should be taught and assessed in the sixth grade of ESs. The difficulty level mode found in the two indicators on sub-aspects of nature conservation is different, as indicator (a) the harmony of nature is found

at level 2 (*easy*) and (b) the conservation and preservation is found at level 3 (*somewhat difficult*). These two indicators are taught in the sixth grade of ESs. If viewed from the content of the material, this sub-aspect has a large and abstract material scope. The material presented in the sub-aspect of the balance of nature is very large, including the earth, atmosphere, hydrosphere, lithosphere and biosphere as well as the conservation and preservation of nature. Based on the stages of children's cognitive development suggested by Piaget, students at the ES level can think logically, but are still limited to concrete things so the learning process still needs to be supported by demonstrations. The more abstract a learning material is, the more difficult the material is for the students. The more difficult the material is, the higher the target learners' level should be. As students at the junior and senior high school level (over 12 years) are able to think abstractly, logically, and ideally, they can analyze a problem scientifically, make a hypothesis, and then solve the problem. Therefore, indicator (b) in this sub-aspect is not suitable for ES students. The sub-aspect of the balance of nature, based on this study, should be taught in the seventh grade of junior high schools (JHSs) as its difficulty level is at level 3 (*somewhat difficult*).

The data from Table 1 also show the mode found in all indicators in the sub-aspect of the nature conservation, which is at level 3 (*somewhat difficult*). Several indicators on the sub-aspect of the nature conservation are started to be taught and assessed in the sixth grade of ESs. Based on the teachers' opinions, when some indicators in this sub-aspect should be taught and assessed are illogical considering the difficulty level that found in this sub-aspect and characteristics of elementary school students. This implies that students need to be directly involved by visiting places that are used as actual examples of the nature conservation so that they can fully understand the material. This study suggests that this sub-aspect should be taught in the seventh grade of JHSs as its level of difficulty is at level 3 (*somewhat difficult*). This would be possible since JHS students are able to think abstractly and analyze any problem raised by the teacher.

All of the data on the difficulty level of the biological resource management aspects that have been obtained and based on logical or illogical considerations were then developed into a learning continuum framework for the biological resource management aspect as presented in Table 2.

Table 2. The learning continuum framework for aspects of biological resource management.

Difficulty levels	Biological Resource Management Aspects	Education Level					
		ES		SJS		SHS	
		Mode	Grade	Mode	Grade	Mode	Grade
Level 1 (Very Easy)	-	-	-	-	-	-	-
Level 2 (easy)	Sub aspects: Kinds of biological natural resources						
	a. Plant	52%	IV	-	-	-	-
	b. Agricultur and Plantation	51%	IV	-	-	-	-
	c. Animal, Livestock and fishery	52%	IV	-	-	-	-
	Sub aspects: Conservation efforts of biological resources						
	a. In-situ maintenance						
	1) Wildlife sanctuary	51%	IV	-	-	-	-
	2) National park	52%	IV	-	-	-	-
	3) Nature preserve	50%	IV	-	-	-	-
	4) Sea park	50%	IV	-	-	-	-
	b. Ex-situ maintenance						
	1) Botanical garden	52%	IV	-	-	-	-
	2) Zoo	52%	IV	-	-	-	-
	3) Forest park botanical garden	52%	IV	-	-	-	-
	c. Conservation efforts of biological resources artificially	45%	VI	-	-	-	-
	d. Conservation efforts of biological resources naturally	53%	VI	-	-	-	-
	Sub aspect: The benefit of biological resources						
	a. The benefit in the environmental field	53%	IV	-	-	-	-
	b. The benefit of biology	54%	IV	-	-	-	-
	c. The benefit of economic field	50%	IV	-	-	-	-
Sub aspects: The balance of nature							
a. The harmony of nature	51%	VI	-	-	-	-	
b. The conservation and presevation	-	-	44%	VII	-	-	
Sub aspects: The nature conservation							
a. The conservation with general purposes							
1) The tight conservation	-	-	43%	VII	-	-	
2) The guide conservation	-	-	41%	VII	-	-	
b. The conservation with certain purposes							
1) Geological protection	-	-	32%	VII	-	-	
2) Anthropology protection	-	-	33%	VII	-	-	
3) Botany conservation	-	-	32%	VII	-	-	
4) Zoology conservation	-	-	33%	VII	-	-	
Level 4 (Difficult)	-	-	-	-	-	-	
Level 5 (Very Difficult)	-	-	-	-	-	-	

Table 2 shows the continuity of learning materials on the aspects of biological resource management, in terms of the difficulty level perceived by the participating teachers. Sub-aspects at level 2 (*easy*) are proposed to be taught in the fourth and sixth grade of ESs, while those at level 3 (somewhat difficult) should be taught in the seventh grade of JHSs.

According to Feiman-Nemser (2001), teachers should understand any subjects they teach if they are responsible for supporting their students learn meaningful content [19]. Identifying the difficulty level of the learning materials is an important point in teaching biology to help the students to better understand them. It is also stated by Anggara et al., that the difficulty of the learning materials should be considered for the appropriate learning process and can resolve the obstacle that may appear in the next learning process [21]. The appropriate arrangement of the learning continuum of biological resource management aspects is important for supporting learning and for obtaining the best learning outcomes that are assessed based on the learning objectives [3]. Learning continuum allows teachers to understand the learning objectives generally and specifically, acts as a reference for teachers in introducing the learning materials from easy to difficult, monitoring the differences of students' learning outcomes, and selecting instructional strategies that best suit the characteristics of the learners [22]. This consistency is supported by a rigorously monitored and integrated teacher training focused on the developmental path of the learners [23].

4. CONCLUSION

Based on the results of this study, the aspects of biological resource management currently taught at school are mostly perceived as *easy* (level 2) and some sub aspects are at level 3 (*somewhat difficult*). This suggests that these aspects have the characteristics and scope of material that are easy to a little difficult. Finally, the present study suggests that the aspects of biological resource management be taught and assessed from the fourth and sixth grades of elementary schools to the seventh grade of junior high schools.

AUTHORS' CONTRIBUTIONS

The Author contributions are in the development of instruments, data collection and processing and reporting of research of result.

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