

Research Article

The learning continuum of anatomical and physiological aspects based on the difficulty levels



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ABSTRACT

Determining the level of difficulty and student development is important in the learning continuum, especially the anatomical and physiological aspects. This study aimed to collect teachers' opinions about the learning continuum of anatomical and physiological aspects based on its difficulty level. This survey research was conducted in the cities of Bantul and Yogyakarta using a questionnaire. The selection of respondents through convenience sampling, totaling 111 teachers consisting of 68 junior high school science teachers and 43 junior high school biology teachers. The data were analyzed using descriptive statistics to determine **the mode of teachers' opinions**. The results of this study indicate that the learning continuum in grade X of senior high school based on difficulty level in anatomical and physiological aspects, especially multicellular and unicellular concept has not yet been formed, with the difficulty at level 4. Therefore it is necessary to the provision of subject matter is sorted from easy to difficult and adjusted to the level of development of students at each level.



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INTRODUCTION

A good teaching and learning system is reflected in the currently implemented curriculum, curriculum development becomes inevitably important to consider (Orizasativa et al., 2019) and its implementation has to be assessed periodically (Suyanto, 2018). A curriculum has some main components, including the competences to achieve and learning materials to master in the learning process (Pramesti & Subali, 2017). Learning materials are the content given to students in the learning process (Pane & Dasopang, 2017). They consist of a sequence of materials that are sourced from the curriculum's content standards and core competencies aimed to achieve graduate competencies (Pramesti & Subali, 2017; Situmorang, 2016). Instructional materials are substances existing in learning activities, and they will be striven to be mastered by students (Pane & Dasopang, 2017). In fact, the materials currently available have possibly not been adjusted to learners' needs (Meilan, 2018). Besides, the learning materials provided to students in the learning process still overlap and are not in accordance with the level of student development (Astuti & Subali, 2017; Juniati &

Subali, 2017), within both levels of education and grades at the same level of education, which will make the assessment process difficult (Ofianto, 2017).

The curriculum developed in Indonesia should be prepared based on the mental development of students (Situmorang, 2016). In addition to the curriculum, teachers have to consider the effectiveness of the arrangement of subject matter appropriately according to time and sequence as well (Fakhrurrazi, 2018). The learning continuum can be developed based on the teacher's opinion because they are directly dealing with students (Astuti & Subali, 2017). If the curriculum development process does not consider the importance of continuous materials at every level of education, the learning process might be ineffective (Andriani & Subali, 2017; Juniati & Subali, 2017; Situmorang, 2016). One of the considerations in the preparation of continuous learning materials is to pay attention to their level of difficulty. The development of the learning continuum, additionally, should show the gradation of difficulty from the easiest to the most difficult materials, from the ES to SHS level (Kusumawati et al., 2019; Subali et al., 2018). A strong foundation in basic science, for instance, will be a prerequisite for science learning at the next level (Mumuni et al., 2016). In other words, the basic materials become the basis for the next materials (Perkins, 2013).

Considering this, the learning continuum has many benefits for the learning process. It allows teachers to understand general and specific learning objectives, deliver the learning materials sequenced from easy to difficult as stipulated in the continuum, monitor differences in student learning outcomes, and choose learning strategies that best suit the mental development of their students (Juniati & Subali, 2017). The learning continuum can also be used as a basis for selecting instructional sources and materials suitable for the mental development of students. In addition, it can also be used as a basis for compiling, improving, and developing a curriculum (Mendala et al., 2019). Learning continuum also can be applied in various branches of education, including Biology (Pramesti & Subali, 2017). Biology is one of the subjects in schools that must be learned by students (Astuti & Subali, 2017). Biology is a branch of science, this science studies about life-related things (Fauzi & Mitalistiani, 2018). Gul and Kose consider biology as a subject that is difficult for learners to learn (Gül & Kose, 2017). It was revealed that there are still many students who get low academic achievement in this subject (Hasibuan & Djulia, 2017; Kusumawati, 2016).

One branch of biology that has low academic value is the anatomy and physiology of living things. This can be proven from the results of the national exams, for the structural and physiological aspects of junior high school and senior high school. Based on the 2019 national exam results report, the national percentage for students who answered correctly on the aspects of the structure and function of living things at the junior high school level was 50, 41% and high school was 49.50%. The low learning outcomes indicate that the characteristics and scope of the anatomical and physiological aspects are difficult and some materials have not been adapted to the level of development of students. Anggara et al., (2018) considers that identifying the difficulties of learning materials needs to be considered in order to prepare the appropriate learning process so that it can resolve obstacles that may appear in the next learning process.

The main reasons of the students' difficulties in learning biology is the characteristics of the learning topic (Firmanshah et al., 2020; Mardin et al., 2017), such as circulation and coordination systems are often considered difficult by students. This is due to the characteristics of the material (Mardin et al., 2017). According to Kusumawati (2016), there are three areas that students consider difficult, such as the structure of plant tissues, the function of plant tissues and relationship between structure and function of plant tissues. Furthermore the learning materials provided to students in the learning process still overlap and are not in accordance with the level of development of students (Astuti & Subali, 2017; Juniati & Subali, 2017). Learning should be sequential, or often referred to as the learning continuum, so that learning is more focused and appropriate with the development of learners (Situmorang, 2016). Therefore the characteristics of the subject matters need to be considered before being given to the students. The subject matter needs to be arranged according to the order of characteristics from easy to difficult.

The learning continuum has many benefits for the learning process. The learning continuum allows teachers to understand general and specific learning objectives, can be used as a reference for teachers in teaching the learning materials that are sequential from easy to difficult, monitor differences in student learning outcomes and choose learning strategies that best suit with the mental development of students (Juniati & Subali, 2017). The learning continuum can also be used as a basis for selecting learning sources and learning materials that are suitable for the mental development of students. In addition, it can also be used as a basis for compiling, improving and developing a curriculum (Mendala et al., 2019). The curriculum developed in Indonesia must be arranged based on the mental development of students (Situmorang, 2016). If the curriculum development process does not consider the importance of continuous material at every level

of education continuously, the learning process will be ineffective (Andriani & Subali, 2017; Juniati & Subali, 2017; Situmorang, 2016).

Learning continuum of anatomical and physiological aspects has done reported by several previous researchers (Astuti & Subali, 2017; Hadi & Subali, 2017). In previous studies, learning continuum of anatomical and physiological aspects were in term of the level of cognitive processes and specific pedagogical materials based on teacher opinions. The findings reported in the previous studies show that many teachers still follow to the implemented curriculum not according to their original thought (Astuti & Subali, 2017; Hadi & Subali, 2017). Other studies related to the learning continuum had been reported such as Genetics (Orizasativa et al., 2019) and reproduction (Trilipi & Subali, 2020), in previous studies the arrangement of the learning continuum was based on the level of cognitive processes. The recent studies on the learning continuum, the arrangement of the learning continuum was based on the level of complexity (Faridah & Subali, 2021). The arrangement of the learning continuum based on the difficulty level of learning material (content knowledge) have not been studied previously. The compilation of material levels from level easy to difficult also needs to be considered to make it easier for teachers to provide subject matter and students understand the subject matter gradually according to the level of mental development.

Based on the descriptions above, the researcher is interested in conducting research that aims to formulate a learning continuum on the anatomical and physiological aspects based on the opinion of science teachers in junior high school and biology teachers in senior high school which is focused on the difficulty levels of learning material. The availability of a learning continuum that fits between the difficulty level of content knowledge and the level of development of students can help students receive a lesson well so that the objectives of learning will be achieved, especially in the anatomical and physiological aspects. The results of this study can be used as a basic reference for the development of learning continuum and curriculum in accordance with the development of students at each level of education.

METHOD

This research is a descriptive by using a survey method aiming to collect the opinion of science teachers in junior high school and biology teachers in senior high school toward the teaching and assessment of anatomical and physiological aspects based on the difficulty levels in the schools. This research was conducted in two regencies / cities in the Special Region of Yogyakarta Province from July to August 2020. The two regencies / cities are Bantul regency and Yogyakarta city. The populations used in this study were Junior High School (JHS) and Senior High School (SHS) teachers. Sample members were selected through convenience sampling, consisting of 111 respondents as representatives of the hypothetical population who had the predetermined characteristics. They comprised 68 JHSs science teachers and 43 SHSs biology teachers. Respondents' demographics are presented in Table 1.

Table 1. Demographic data of the participating teachers

Group of respondents	Based on education programs		Total
	Education Department n (%)	Non-education Department n (%)	
JHS Teachers	53 (78)	15 (22)	68
SHS Teachers	37(86)	6 (14)	43

Data were collected using a questionnaire about the level of difficulty of the anatomical and physiological aspects that is given to the respondents (science and biology teachers). The questionnaire was then distributed to respondents via a Google form. The anatomical and physiological aspects are presented in the questionnaire consisted of three sub-aspects, namely 1) The internal structure (anatomical) of the multicellular organism's body and its functions, 2) The anatomical structure of the unicellular organism and its functions, 3) The anatomical structure of the virus body and its functions. In this study, the difficulty level was determined which consisted of five levels, namely "very easy" (1), "easy" (2), "rather difficult" (3), "difficult" (4), "very difficult" (5). The questionnaire given to respondents is equipped with an explanation of the level of difficulty along with an example at the beginning of the questionnaire to equalize the perceptions of all respondents on the difficulty level criteria. The organization of teaching materials is also based on the level of difficulty of facts and concepts (from the very easy to the most difficult). For example, the fact of the body of a virus is very difficult to observe because it can only be observed using an electron microscope. Likewise, the facts about bacteria and single-cell organisms are difficult to observe because they require a microscope to observe

them, while the facts about large animals and plants are very easy to observe. The concept of how viruses can function in living cells is also elusive.

All opinions from the questionnaire will be recapitulated. The data were analyzed by searching for the **mode of respondents'** opinions and then compiled as a teaching material grid. This mode shows an agreement between the respondents (junior high school science teachers and biology teachers). The mode value obtained can show how difficult the anatomical and physiological aspects are and what grade these aspects should be taught, so that the learning continuum sequence can be arranged.

RESULTS AND DISCUSSION

The results of the teacher's opinion about the difficulty levels of the anatomical and physiological aspects that must be taught in schools were obtained from 111 teachers consisting of 68 junior high schools (JHSs) science teachers and 43 senior high schools (SHSs) biology teachers in two regencies/cities in the Special Region of Yogyakarta Province. Aspects of anatomy and physiology have three sub-aspects including sub-aspects the internal structures (anatomical) of the body of multicellular organisms and their functions, sub-aspect of the anatomical structures of the virus and their functions, the anatomical structures of the virus and their functions. Data on the difficulty levels of sub-aspect the internal structures (anatomical) of the body of multicellular organisms and their functions have resulted the findings as shown in [Table 2](#) as follows:

Table 2. The JHS and SHS **teachers' opinions about the difficulty level of the anatomy** and physiology aspects in the sub-aspect of the internal structures (anatomical) of the body of multicellular organisms and their functions

		Sub-aspects 1: the internal structure (anatomical) of the body of multicellular organisms and their functions	JHS ^a teachers' opinion (n ^c =68)		SHS ^b teachers' opinion (n ^c =43)	
			Mo ^d	CI ^e /DL ^f	Mo ^d	CI ^e /DL ^f
1.	The Fern Organ	a. The anatomical structure of the fern organs and their functions	45	VIII/4 ^j	25	X/3 ⁱ
		b. Factors that affect the anatomical structure and function	41	VIII/4 ^j	22	X/3 ⁱ
2.	The Mosses Organs	a. The anatomical structure of the mosses organs and their functions	46	VII/4 ^j	24	X/3 ⁱ
		b. Factors that affect the anatomical structure and function	45	VII/4 ^j	25	X/4 ^j
3.	The Algae Organs	a. The anatomical structure of the algae organs (plant-like protists) and their functions	45	VII/4 ^j	25	X/3 ⁱ
		b. Factors that affect the anatomical structure and function	42	VII/4 ^j	22	X/4 ^j
4.	The Tissues that Make Up The Organs of Algae	a. The anatomical structure of the tissues that make up the organs of algae (plant-like protists) and their functions	43	X/4 ^j	20	X/4 ^j
		b. Factors that affect the anatomical structure and function	42	X/4 ^j	23	X/4 ^j
5.	Flowering Plant Organs	a. The anatomical structures of flowering plant organs and their functions	45	VIII/3 ⁱ	23	XI/3 ⁱ
		b. Factors that affect the anatomical structure and function	39	VIII/3 ⁱ	25	XI/4 ^j
6.	The Tissue Composing Fern Organs	a. The anatomical structure of the tissue composing fern organs and their functions	43	VIII/4 ^j	21	X/4 ^j
		b. Factors that affect the anatomical structure and function	45	X/4 ^j	24	X/4 ^j
7.	The Tissue of The Mosses	a. The anatomical structure of the tissue of the mosses and their functions	46	X/4 ^j	21	X/4 ^j
		b. Factors that affect the anatomical structure and function	41	X/4 ^j	25	X/4 ^j
8.	Cells that Make Up Fungal Tissues	a. The anatomical structure cells that make up fungal tissues and their functions	42	X/4 ^j	23	X/4 ^j
		b. Factors that affect the anatomical structure and function	41	X/4 ^j	25	X/4 ^j
9.	The Fungal Body Cells	a. The anatomical structure of the fungal body cells and their functions	39	X/4 ^j	22	X/4 ^j
		b. Factors that affect the anatomical structure and function	39	X/4 ^j	23	X/4 ^j
10.	Human and Animal Organ Systems	a. The anatomical structures of human and animal organ systems and their functions	38	VIII/4 ^j	22	XI/4 ^j
		b. Factors that affect the anatomical structure and	40	VIII/4 ^j	28	XI/4 ^j

	Sub-aspects 1: the internal structure (anatomical) of the body of multicellular organisms and their functions	JHS ^a teachers' opinion (n ^c =68)		SHS ^b teachers' opinion (n ^c =43)	
		Mo ^d	Cl ^e /DL ^f	Mo ^d	Cl ^e /DL ^f
	function				
11. Human and Animal Organs	a. The anatomical structures of human and animal organs and their functions	39	VIII/4 ^j	23	XI/4 ^j
	b. Factors that affect the anatomical structure and function	39	VIII/4 ^j	24	XI/4 ^j
12. Human and Animal Tissues	a. The anatomical structures of human and animal tissues and their functions	40	VIII/4 ^j	24	XI/4 ^j
	b. Factors that affect the anatomical structure and function	46	VIII/4 ^j	29	XI/4 ^j
13. Plant Tissue Composing Flowering Organs	a. The anatomical structure of plant tissue composing flowering organs and their functions	41	VIII/4 ^j	22	XI/4 ^j
	b. Factors that affect the anatomical structure and function	38	VIII/4 ^j	23	XI/4 ^j
14. Cells that Make Up Human and Animal Tissues	a. The anatomical structure of cells that make up human and animal tissues and their functions	44	VIII/4 ^j	29	XI/4 ^j
	b. Factors that affect the anatomical structure and function	47	VIII/4 ^j	30	XI/4 ^j
15. The Tissue Making Cells in The Plant Body	a. The anatomical structure of cells making tissue in the plant body and their functions	45	VIII/4 ^j	22	XI/4 ^j
	b. Factors that affect the anatomical structure and function	44	VIII/4 ^j	23	XI/4 ^j
16. Human and Animal Cells and Their Function	a. The anatomical structure of human and animal cells and their functions	41	VIII/4 ^j	29	XI/4 ^j
	b. Factors that affect the anatomical structure and function	40	XI/4 ^j	31	XI/4 ^j
17. Cells in The Plant Body	a. The anatomical structure of cells in the plant body and their functions	43	VIII/4 ^j	29	XI/4 ^j
	b. Factors that affect the anatomical structure and function	42	VIII/4 ^j	30	XI/4 ^j

Note: (a) Junior High School; (b) Senior High School; (c) Total Respondent; (d) Mode; (e) Class; (f) Difficulty Level; (g) Very Easy; (h) Easy; (i) Rather Difficult, (j) Difficult, (k) Very Difficult

Table 2 shows that the level of understanding each groups of practitioners (teachers) is quite high based on the resulting mode values. The JHS and SHS teachers had the same perceptions regarding the level of difficulty in most of the material in the sub-aspects internal structures (anatomical) of the multicellular organism body and their functions. The JHS and SHS teachers opine that most of the material in this sub-aspect has a level of difficulty at level 4 (difficult), except in material of the fern organs, the mosses organs (indicator *a*), the algae organs (indicator *a*) and flowering plant organs (indicator *b*) which have a difficulty level at level 3 (rather difficult). The JHS teachers believe that most of the material in sub-aspect international structures (anatomical) of multicellular organism body and their functions can be taught at JHS level. The mosses organs and the algae organs can be taught in grade VII while the fern organ, flowering plant organs, the tissue composing fern organs (indicator *a*), human and animal organ systems, human and animal organs, human and animal tissues, plant tissue composing flowering organs, cells that make up human and animal tissues, the tissue making cells in the plant body, human and animal cells and their function (indicator *a*) and cells in the plant body are taught in grade VIII and some other material such as the tissues that make up the organs of algae, the tissue composing fern organs (indicator *b*), the tissue of the mosses, cells that make up fungal tissues, the fungal body cells and human and animal cells and their function (indicator *b*) not suitable for the development level of JHS students. The difficulty of students in understanding the material can be seen from the implementation of the curriculum, if it is appropriate then the teacher is easier to prepare the material according to the development of the students (Juniati & Subali, 2017).

Based on previous research, (Hadiprayitno et al., 2019) reported that cell structure and function consider difficult by students. On other hand, according to SHS teachers, some sub-aspects internal structures (anatomical) of the multicellular organism body and their functions such as the fern organ, the mosses organs, the algae organs, the tissues that make up the organs of algae, flowering plant organs, the tissue composing fern organs, the tissue of the mosses, cells that make up fungal tissues, and the fungal body cells can be taught in grade X while flowering plant organs, human and animal organ systems, human and animal organs, human and animal tissues, plant tissue composing flowering organs, cells that make up human and animal tissues, the tissue making cells in the plant body, human and animal cells and their function and cells in the

plant body are taught in grade XI SHS. Data on the difficulty levels of sub-aspects of the anatomical structure of unicellular organisms and their functions have resulted the findings as shown in Table 3.

Table 3. The JHS and SHS teachers' opinions about the difficulty level of the anatomy and physiology aspects in the sub-aspect of the anatomical structure of unicellular organisms and their functions

Sub-aspect 2: Anatomical structure of unicellular organisms and their functions	JHS ^a teachers' opinion (n ^c =68)		SHS ^b teachers' opinion (n ^c =43)	
	Mo ^d	Cl ^s / ^e /DL ^f	Mo ^d	Cl ^s / ^e /DL ^f
The anatomical structure of the cells that make up the body of the Protista and their functions	39	X/4 ^j	22	X/4 ^j
The anatomical structure of the cells that make up Monera's body and their functions	39	X/4 ^j	23	X/4 ^j
The anatomical structure of the cells that make up the body of bacteria and their functions	38	X/4 ^j	22	X/4 ^j
Factors that affect the anatomical structure of the cells that make up the body of unicellular organisms	40	X/4 ^j	26	X/4 ^j

Note: (a) Junior High School; (b) Senior High School; (c) Total Respondent; (d) Mode; (e) Class; (f) Difficulty Level; (g) Very Easy; (h) Easy; (i) Rather Difficult, (j) Difficult, (k) Very Difficult

Table 3 shows that the level of understanding each groups of practitioners (teachers) is quite high based on the resulting mode values. The JHS and SHS teachers had the same perceptions regarding the level of difficulty and when this sub-aspect can be taught in the sub-aspects of the anatomical structure of unicellular organisms and their functions. The JHS and SHS teachers opine that most of the material in this sub-aspect has a level of difficulty at level 4 (difficult) and and more suitable to be taught in grade X SHS. Based on previous report, Archaeobacteria and Eubacteria (Hidayatussaadah et al., 2016; Hadiprayitno et al., 2019) were biological topics that are often considered difficult by students. Hidayatussaadah et al., (2016) also reported that explaining the classification of Eubacteria based on cell wall characteristics being the most difficult competency for students. Several previous reports also confirmed that Protista (Sukiya & Sudarsono, 2017) was biological topic that is often considered difficult by students. Data on the difficulty levels of sub-aspects of the structure of the virus and its functions have resulted the findings as shown in Table 4 as follows:

Table 4. The JHS and SHS teachers' opinions about the difficulty level of the anatomical and physiological aspects of in the sub-aspect of the anatomical structures of the virus and their functions

Sub-aspect 3: of the anatomical structure of the virus and its functions	JHS ^a Teachers' Opinion (n ^c =68)		SHS ^b Teachers' Opinion (n ^c =43)	
	Mo ^d	Cl ^s / ^e /DL ^f	Mo ^d	Cl ^s / ^e /DL ^f
The anatomical structure of the virus body and its functions	37	X/4 ^j	22	X/4 ^j
Factors affecting the anatomical structure of the virus body and its function	42	X/4 ^j	24	X/4 ^j

Note: (a) Junior High School; (b) Senior High School; (c) Total Respondent; (d) Mode; (e) Class; (f) Difficulty Level; (g) Very Easy; (h) Easy; (i) Rather Difficult, (j) Difficult, (k) Very Difficult

Table 4 shows that the level of understanding each groups of practitioners (teachers) is quite high based on the resulting mode values. The JHS and SHS teachers had the same perceptions regarding the level of difficulty and when the sub-aspects of the structure of the virus and its functions can be taught. The JHS and SHS teachers opine that two material in this sub-aspect has a level of difficulty at level 4 (difficult) and more suitable to be taught in grade X SHS. Previous reports also confirmed that difficult topics in biology are bacteria and viruses (Hadiprayitno et al., 2019) because most students consider these concepts as abstract and complex (Harahap & Nasution, 2018). Previous reports also confirmed that virus (Hasibuan & Djulia, 2017) often considered difficult by students. Therefore this aspect is more suitable to be taught at the high school level. The presentation of the learning continuum grid for the anatomical and physiological aspects of living things based on science teachers' opinions in JHS and biology teachers in SHS is described in Table 5.

The results of learning continuum grid of anatomical and physiological aspects based on difficulty level presented in the Table 5 illustrates that this aspect is started to be taught at grade VII JHS to grade XI SHS. Some indicators in the sub-aspects internal structures (anatomical) of the multicellular organism body and their functions presented in the Table 5 has not shown the hierarchical level between the difficulty levels and the class level where an aspect is taught. This indicate that the opinion of the teachers has not paid attention to the learning continuum, this can be seen from the acquisition of difficulty level mode and class level. For example, indicator e in the sub-aspects internal structures (anatomical) of the multicellular organism body and their functions with a mode that are at level 4 (difficult) to be taught in eighth grade Senior high school then re-

taught in grade X high school with a lower level (level 3). In other cases for some indicators, for example, indicator *f* in sub-aspects internal structures (anatomical) of the multicellular organism body and their functions is taught in grade VII JHS with a level of difficulty at level 4 (difficult) and then re-taught in grade X with the same level of difficulty. Difficult learning can be overcome by adjusting the indicators and the level of the material (Mendala et al., 2019).

Table 5. Learning continuum grid of anatomical and physiological aspects

Anatomical and Physiological Aspects	Education Level					
	ES ^a		JHS ^b		SHS ^c	
	DL ^d	Cl ^e	DL ^d	Cl ^e	DL ^d	Cl ^e
Sub-aspects 1: the internal structure (anatomical) of the body of multicellular organisms and their functions						
a. The anatomical structures of flowering plant organs and their functions	-	-	3 ^h	VIII	3 ^h -4 ⁱ	XI
b. The anatomical structure of the mosses and their functions	-	-	4 ⁱ	VIII	3 ^h -4 ⁱ	X
c. The anatomical structure of the algae organs (plant-like protists) and their functions	-	-	4 ⁱ	VII	3 ^h -4 ⁱ	X
d. The anatomical structure of the tissues that make up the organs of algae (plant-like protists) and their functions	-	-	-	-	4 ⁱ	X
e. The anatomical structure of the fern organs and their functions	-	-	4 ⁱ	VIII	3 ^h	X
f. Anatomical structure of the tissue composing fern organs and their functions	-	-	4 ⁱ	VIII	4 ⁱ	X
g. The anatomical structure of the tissue of the mosses and their functions	-	-	-	-	4 ⁱ	X
h. The anatomical structure cells that make up fungal tissues and their functions	-	-	-	-	4 ⁱ	X
i. The anatomical structure of the fungal body cells and their functions	-	-	-	-	4 ⁱ	X
j. The anatomical structures of human and animal organ systems and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
k. The anatomical structures of human and animal organs and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
l. The anatomical structures of human and animal tissues and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
m. The anatomical structure of plant tissue composing flowering organs and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
n. The anatomical structure of cells that make up human and animal tissues and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
o. The anatomical structure of the tissue making cells in the plant body and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
p. The anatomical structure of human and animal cells and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
q. The anatomical structure of cells in the plant body and their functions	-	-	4 ⁱ	VIII	4 ⁱ	XI
Sub-aspect 2: Anatomical structure of unicellular organisms and their functions						
a. The anatomical structure of the cells that make up the body of the Protista and their functions	-	-	-	-	4 ⁱ	X
b. The anatomical structure of the cells that make up Monera's body and their functions	-	-	-	-	4 ⁱ	X
c. The anatomical structure of the cells that make up the body of bacteria and their functions	-	-	-	-	4 ⁱ	X
d. Factors that affect the anatomical structure of the cells that make up the body of unicellular organisms	-	-	-	-	4 ⁱ	X
Sub-aspect 3: of the anatomical structure of the virus body and its functions						
a. The anatomical structure of the virus body and its functions	-	-	-	-	4 ⁱ	X
b. Factors affecting the anatomical structure of the virus body and its function	-	-	-	-	4 ⁱ	X

Note: (a) Elementary School; (b) Junior High School; (c) Senior High School; (d) Difficulty Level; (e) Class; (f) Very Easy; (g) Easy; (h) Rather difficult; (i) Difficult; (j) Very Difficult

Continuity needs to be considered, especially with regard to the material that will be given to students, lest there be repetition of material or jumps for which the level of difficulty is not clear (Sugiana, 2018). Ideally the materials / indicators are taught in a sequence from easy to difficult, the more difficult the material/indicator is,

the higher level/class the material / indicator should be taught. It is also stated by [Subali et al., \(2018\)](#) that if these sub-aspects are included in the easy-to-learn category, then these sub-aspects can be taught in the beginning level ([Kusumawati et al., 2019](#)). It is better if the class level is chosen according to the order of difficulty, the higher the level of difficulty of a material / indicator, the higher grade/level the material is taught so as not to jump from easy to difficult then back to easy again. So that there is no overlap of learning material. A material that is taught repeatedly shows that the composition of the material follows the spiral curriculum rules ([Faridah & Subali, 2021](#)). Two sub-aspects in this aspect such as the sub-aspects of the anatomical structure of unicellular organisms and their functions and the sub-aspects of the structure of the virus and its functions are only taught at the SHS level grade X with a level of difficulty at level 4.

Good adjustment of learning materials will help students better understand the learning topic. According to [Feiman-Nemser \(2001\)](#); [Trilipi and Subali \(2020\)](#), teachers must understand the subjects they teach, if they are responsible for supporting students to learn useful content. It is important for the teachers continuously do reflection and evaluation related with their learning problems encountered so that it can be obtained immediately the right solution ([Priyayi et al., 2018](#)). Teacher observing the inter-related processes of following to teaching and learning situations, and making instructional decisions is a critical part of teaching expertise ([Ivars et al., 2018](#); [Subali et al., 2018](#)). Identifying the level of difficulty in learning material is important in teaching biology especially anatomical and physiological aspects so that it can help students understand the material. On the other hand, teachers can find it easier to pay attention to relevant instructional details when given a focus point on the problems faced by students ([Ivars et al., 2018](#)).

We need innovation in learning that leads directly to students. The learning continuum based on the difficulty level could adjust to the ability level of students so that students can carry out effective and efficient learning. Learning continuum represents an increase in the skills of learners from basic skills to the highest skills at a certain level ([Ofianto, 2017](#)). The scope of the learning material in the content standard should be formulated based on the development of students so that the scientific concept is in line with the knowledge gained and there is suitability for each level ([Hadi & Subali, 2017](#)). Therefore, the 2013 curriculum that is being developed must be formulated based on the level of student development ([Hadi & Subali, 2017](#); [Situmorang, 2016](#)). This research was still limited to the opinion of science teachers of junior high schools and biology teachers of senior high schools, therefore it is necessary to do further research by asking the opinion of biology education experts and conducting FGD (Focus Group Discussion) between teachers and biology education experts to consider the results obtained. Teachers think practically because they deal directly with students while biology education experts think theoretically, therefore it is necessary to conduct FGD between teachers and biology education experts to consider the results obtained so that the learning continuum arranged will fit between the difficulty level of the teaching material and level of development of learners.

CONCLUSION

Based on the results of the study according to the JHS and SHS teachers' **opinion**, the learning continuum based on the difficulty level in the the sub-aspects internal structures (anatomical) of the multicellular organism body and their functions in anatomical and physiological aspects has not yet been formed. Two sub-aspects in this aspect such as the sub-aspects of the anatomical structure of unicellular organisms and their functions and the sub-aspects of the structure of the virus and its functions are only taught at the SHS level grade x with a level of difficulty at level 4. Finally, we suggest provision of subject matter is sorted from easy to difficult and adjusted to the level of development of students at each level. This research was still limited to the opinion of science teachers of junior high school and biology teachers of senior high school, therefore it is necessary to do further research by asking the opinion of biology education experts and conducting FGD (focus group discussion) between teachers and biology education experts to consider the results obtained.

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REFERENCES

- Andriani, A. E., & Subali, B. (2017). Teachers' opinion about learning continuum based on student's level of competence and specific pedagogical material in classification topics. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995211>
- Anggara, B., Priatna, N., & Juandi, D. (2018). Learning difficulties of senior high school students based on probability understanding levels. *Journal of Physics: Conference Series*, 1013 (1). <https://doi.org/10.1088/1742-6596/1013/1/012116>
- Astuti, L. D., & Subali, B. (2017). Teacher's opinions about learning continuum based on the student's level of competence and specific pedagogical materials on anatomical aspects. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995215>
- Fakhrurrazi. (2018). Hakikat Pembelajaran yang efektif. *Jurnal At-Ta'kir*, XI(1), 85–99. <https://doi.org/10.32505/at.v11i1.529>
- Faridah, H., & Subali, B. (2021). Teachers' opinion about learning continuum in evolution based on the material complexity level. *JPBI (Jurnal Pendidikan Biologi Indonesia)*. 7(1), 53–62. <https://ejournal.umm.ac.id/index.php/jpbi/article/view/13680>
- Fauzi, A., & Mitalistiani, M. (2018). High school biology topics that perceived difficult by undergraduate students. *DIDAKTIKA BIOLOGI: Jurnal Penelitian Pendidikan Biologi*, 2(2), 73. <https://doi.org/10.32502/dikbio.v2i2.1242>
- Feiman-Nemser, S. (2001). From preparation to practice: Designing a continuum to strengthen and sustain teaching. *Teachers College Record*, 103(6), 1013–1055. <https://doi.org/10.1111/0161-4681.00141>
- Firmansyah, M. I., Jamaluddin, J., & Hadiprayitno, G. (2020). Learning difficulties in comprehending virus and bacteria material for senior high schools. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 6(1), 165–172. <https://doi.org/10.22219/jpbi.v6i1.10981>
- Gül, S., & Kose, E. Ö. (2017). Prospective teachers' perceptions on protein synthesis: Recommended Solutions versus learning difficulty. *Eefdergi*, 20(1), 237–250. <https://doi.org/https://dx.doi.org/10.33225/jbse/18.17.19>
- Hadi, R. F., & Subali, B. (2017). The learning continuum based on student's level of competence and specific pedagogical learning material on physiological aspects from teachers's opinions. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995216>
- Hadiprayitno, G., Muhlis, & Kusmiyati. (2019). Problems in learning biology for senior high schools in Lombok Island. *Journal of Physics: Conference Series*, 1241(1). <https://doi.org/10.1088/1742-6596/1241/1/012054>
- Harahap, F. D. S., & Nasution, M. Y. (2018). Analisis kesulitan belajar siswa pada materi virus di kelas X MIPA SMA Negeri 1 Rantau Selatan Tahun Pembelajaran 2017/2018. *Jurnal Pelita Pendidikan*, 6(2), 71–78. <https://doi.org/10.24114/jpp.v6i2.10141>
- Hasibuan, H., & Djulia, E. (2017). Analisis kesulitan belajar siswa pada materi virus di kelas X Aliyah Al-Fajri Tanjungbalai Tahun Pembelajaran 2016 / 2017. *Jurnal Pelita Pendidikan*, 4(4), 16–24. <https://jurnal.unimed.ac.id/2012/index.php/pelita/article/view/6629/7180>
- Hidayatussaadah, R., Hidayati, S., & Umniyati, S. (2016). Identifikasi kesulitan belajar siswa pada materi archaeobacteria dan eubacteria di SMA Negeri 1 Muntilan. *Jurnal Pendidikan Biologi*, 5(7), 58–69. <http://journal.student.uny.ac.id/ojs/index.php/pbio/article/view/4635>
- Ivars, P., Fernández, C., Llinares, S., & Choy, B. H. (2018). Enhancing noticing: Using a hypothetical learning trajectory to improve pre-service primary teachers' professional discourse. *Eurasia Journal of Mathematics, Science and Technology Education*, 14(11). <https://doi.org/10.29333/ejmste/93421>
- Juniati, E., & Subali, B. (2017). Teacher's opinion about learning continuum of genetics based on student's level of competence. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995212>
- Kusumawati, M. U. (2016). Identifikasi kesulitan belajar materi struktur - fungsi jaringan tumbuhan pada siswa SMA Negeri 3 Klaten Kelas XI Tahun Ajaran 2015/2016. *Jurnal Pendidikan Biologi*, 5(7), 19–26. <https://eprints.uny.ac.id/44757/>
- Kusumawati, M. U., Subali, B., & Paidi. (2019). Developing a learning continuum of biological resources management aspect from elementary school to senior high school based on the experts' opinions. *Journal of Physics: Conference Series*, 1397(1). <https://doi.org/10.1088/1742-6596/1397/1/012052>
- Mardin, H., B., N., & Ramlawati. (2017). Analisis kesulitan belajar biologi peserta didik kelas XII IPA SMA Negeri di Kota Palopo. <http://eprints.unm.ac.id/5840/>

- Meilan, A. (2018). Pengembangan bahan ajar mata kuliah penulisan kreatif bermuatan nilai-nilai pendidikan karakter religius bagi mahasiswa Prodi PBSI, FKIP, UNISSULA. *Jurnal Kredo*, 1(2), 71–90. <https://jurnal.umk.ac.id/index.php/kredo/article/view/2107>
- Mendala, Subali, B., & Paidi. (2019). Developing a learning continuum on ecological aspect from elementary to senior high school based on the opinions of biology education experts. *Journal of Physics: Conference Series*, 1397(1). <https://doi.org/10.1088/1742-6596/1397/1/012053>
- Mumuni, A. O. A., Dike, J. W., & Uzoma-Nwogu, A. (2016). Teaching Trajectories and students' understanding of difficult concepts in biology in obio/akpor local government area in rivers state. *World Journal of Education*, 7(1), 44. <https://doi.org/10.5430/wje.v7n1p44>
- Ofianto. (2017). Model Learning continuum keterampilan berpikir historis (historical thinking) pembelajaran sejarah SMA. *Diakronika*, 17(2), 163–177. <https://doi.org/10.24036/diakronika/vol17-iss2/27>
- Orizasativa, L., Subali, B., & Paidi. (2019). Developing a learning continuum of the pedagogic materials of genetics aspects from elementary school to senior high school level based on the opinions of biology education experts. *Journal of Physics: Conference Series*, 1397, 1–7. <https://doi.org/10.1088/1742-6596/1397/1/012051>
- Pane, A., & Dasopang, M. D. (2017). Belajar dan pembelajaran. *Fitrah Jurnal Kajian Ilmu-Ilmu Keislaman*, 03(2), 333–352. <http://jurnal.iain-padangsidempuan.ac.id/index.php/F/article/view/945/0>
- Perkins, K. (2013). A conceptual paper on the application of the picture word inductive model using Bruner's constructivist view of learning and the Cognitive Load Theory. *Interdisciplinary Journal of Teaching and Learning*, 3(1), 8–17. <https://files.eric.ed.gov/fulltext/EJ1063072.pdf>
- Pramesti, I. C., & Subali, B. (2017). The learning continuum of ecology based on teachers' opinion about student's level of competence and specific pedagogical learning material. *AIP Conference Proceedings*, 1868. <https://doi.org/10.1063/1.4995213>
- Priyayi, D. F., Keliat, N. R., & Hastuti, S. P. (2018). Masalah dalam pembelajaran menurut perspektif guru biologi sekolah menengah atas (SMA) di Salatiga dan Kabupaten Semarang. *Didaktika Biologi: Jurnal Penelitian Pendidikan Biologi*, 2(2), 85–92. <https://jurnal.um-palembang.ac.id/dikbio/article/view/1243>
- Situmorang, R. P. (2016). Analisis learning continuum tingkat SD sampai SMP pada tema sistem pencernaan manusia. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, 6(2), 1. <https://doi.org/10.24246/j.scholaria.2016.v6.i2.p1-13>
- Subali, B., Kumaidi, & Aminah, N. S. (2018). Developing a scientific learning continuum of natural science subjects at grades 1 - 4. *Journal of Turkish Science Education*, 15(2), 66–81. <https://www.tused.org/index.php/tused/article/view/217>
- Sugiana, A. (2018). Proses pengembangan organisasi kurikulum dalam meningkatkan pendidikan di Indonesia. *Jurnal Pedagogik*, 05(02), 257–273. <https://ejournal.unuja.ac.id/index.php/pedagogik>
- Sukiya, F., & Sudarsono. (2017). Analysis Learning Difficulty Protist Man in Wonosobo Regency Year 2016/2017. *Jurnal Prodi Pendidikan Biologi*, 6(7), 36–37. <http://journal.student.uny.ac.id/ojs/index.php/pbio/article/download/8172/7767>
- Suyanto, S. (2018). The implementation of the scientific approach through 5ms of the revised curriculum 2013 in Indonesia. *Cakrawala Pendidikan*, XXXVII(1), 22–29. <https://doi.org/10.1017/CBO9781107415324.004>
- Trilipi, D., & Subali, B. (2020). The learning continuum of living reproduction: Generating a curriculum grid based on students' cognitive levels. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 6(3), 389–396. <https://doi.org/10.22219/jpbi.v6i3.13660>