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Analysis of students' difficulties on the material elasticity and harmonic oscillation in the inquiry-based physics learning in senior high school

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Abstract. The purpose of this research is to analyze of students' difficulties on the material elasticity and harmonic oscillation in the inquiry-based physics learning. It has eight stages. They are the orientation, the problem formulation, the formulation of hypotheses, the data obtaining, the testing hypotheses, conclusions, the implementation of the conclusions and generalizations, and the reflection stage. This research determines the student's learning difficulties on the each stage. The subject of this research is all of the students in X IPA 4 SMA N Sambungmacan Sragen. The amount of this research subject is thirty students. The method used in this research is descriptive qualitative. The data acquired with the learning process observation, the student's response questionnaire, and the student's cognitive tests. The results show that the student has difficulty in analyzing the elasticity and the force of deviation, speed, and acceleration concept, illustrates hooke law, and the matter's modulus elasticity. The difficult stages of the inquiry-based physics learning are the problem formulation, the formulation of hypotheses, the data obtaining, the testing hypotheses, conclusions, the implementation of the conclusions and generalizations, and the reflection stage.

Keyword : students' difficulties, elasticity and harmonic oscillation, inquiry

1. Introduction

In the formal education, the physics's learning is one of the learning subjects that has an important role in supporting of science and technology development. The good understanding of physics concepts is one of the student's preparations to facing their future. The good understanding of physics concepts can also prepare the student to get a higher education.

Based on researches, there are many learning problems on the physics learning in formal education school. The identified learning problems on the physics are: (1) The physic learning's material is too difficult to be understood because the recitation and numeric is too much (2) Mostly student don't like a physics teacher personally (3) The merely presentation and lack of science activity learning methods (4) The unrepresentative and unsuitable learning media (5) The lack of student's participations in learning activity (6) Students have not understand the uses of physical concepts (7) The learning material is focused on the completeness of student's performance with the physics formulas (8) The lack of teacher's appreciation for student's achievements (Wiyanto *et al.,* 2006: 64-66; Samudra, Suastra &Suma, 2014: 2; Solikin & Abdullah, 2004: 11).

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The problems of physics learning must be solved to build an attracting physics learning. One of the solutions is applying the right-choice learning methods. The mere presentation and lack of science activity learning methods that often used by almost physics teacher must be changed to the another learning method. The suitable learning methods that can be implemented to this lesson is inquiry based learning methods. The changing of learning methods can make several problems. The problems can be taken by teacher and student. The student problem can be indicated with student's learning difficulties in the each stage on the learning method applied.

SMA N Sambungmacan is the one of senior high school in Indonesia that begin to changes the physics learning methods. They have been to try use inquiry based methods. One of this lesson material that the student should be learned is the elasticity and harmonic oscillation. According to the result of an interview with one of physics teacher in SMA N Sambungmacan, the elasticity and harmonic oscillation concepts is deemed to be one of the unmastered physics concepts by students in senior high school level. In the formal education of Indonesia, the elasticity, and harmonic oscillation is taught for students of grade X (ten). This lesson material is especially given to mathematic and natural sciences department.

Research of Erb (Tuan, et al., 2005) explain that motivation to learn for the group of science subject specially at student of senior high school is low. The Low learning motivation level of science subject group is influenced by some important factor. Other research by Hyind, Holschuh & Nist(2000) identified that factors influencing students' motivation in learning science come from within student itself and teacher. The Factor comes from student itself that is student interest to learn science, orientation factor or target of students learning, and desire of student to be more study nature. The teacher factor that has an effect to motivate learn student is curriculum, interaction learning method and student applied by teacher. Velayutham, Aldridge, and Fraser (2011) states the important reason to know learning motivation level for the subject of science because learning motivation to base on conception process materials, critical thinking, learning strategy, and learning success. Wang, et al(2015) explain his research result which is done in three senior high school in Taiwan for the subject of science. Result indicate that method of inquiry improve learning motivation science and interest of student to learn science.

Based on the explanation above, this paper will explain the result of the to analyze the learning difficulties of students in SMA N Sambungmacan especially on the inquiry based physics learning in X IA 4 class.

2. Material

2.1. Learning difficulties

The Hammil (Abidin, 2006:10) defines learning difficulties are a group of difficulties that manifest in the real form of it in proficiency and the use of the ability listening, covering, reading, writing, analyzing, or ability in a particular of lesson subject. According to Warkiti et al. (1990:83) are the presence of a distance between the expected academic achievement with academic achievement obtained. Siti Mardiyatin et al. (1994:4-5) defines the difficulty of learning as a learning process condition which is characterized by the existence obstacles to achieving the results of the study. Indeed, Every person is different. These individual differences make the difference in learning

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behavior among the students. The learning difficulties is the condition that student can not learn in the right way.

Research from Neilson, Campbell, and Allred (2010) explain that easier student comprehend lesson through activity directly. Learning method emphasizes experiment process to make student more confidence to their ability.

The material elasticity and harmonic oscillation can be found in the daily cativity, for example in children's toy Ketapel, swing, motor spare part in shockbreaker which make us comfort to ride it and at spring in bed which make us comfort in sleeping. All tools use elasticity and harmonic oscillation. to know more, the students try to identify in learning physic. An appropiate method used by the teacher is inquiry.

2.2. Inquiry

Inquiry based learning is one of the models of learning that focuses on the student's activities in the learning process. Inquiry based learning was first developed by Richard Suchman 1962 (Joyce, 2000). He wanted students to ask why an event happened, then he taught students about the procedure and use the organization's knowledge and general principles. Students are doing activities, collecting and analyzing data, until finally the students finding answers to that questions.

An Inquiry is divided into two group based on tuition factor of teacher, that is free inquiry and guided inquiry. Guided inquiry is learning inquiry which teacher execution give problems and push students to finish problems and find conception from problems (Bilgin, 2009). Teacher give tuition in step of inquiry to instruct student in concept construction. A guided inquiry learning is learning activity which is done by student in developing knowledge and understanding of scientific idea, as have done by scientist in comprehending natural phenomenon (Wenning, 2005). Learning inquiry method is applied in learning physics because physics not merely knowledge containing concept and fact but also containing investigation process.

Hussain, Azeem, dan Shakoor (2011) explain that physic learning using inquiry method have significantly influent toward students achievement. In other side, the research from Kirschner, Sweller & Clark(2006) obtained that there is misunderstanding from students itself because the students are less in organizing knowledge which is gotten through guided inquiry method applied by the teacher. Based on to facts, to anticipate student misunderstanding because process of guided inquiry based on to research of Kirschner, Sweller & Clark (2006). Pedaste, et al. (2015) states that study based on inquiry major in experiment process to prove anticipation whereas which is formulated. Inquiry learning have positive value because student as learners claimed to construct knowledge which is studying so that knowledge become more is having a meaning.

2.3. Inquiry based learning syntax

Like another learning methods, the Inquiry based learning has several stages that must go to do. There are many authors has been identifying the inquiry based learning syntax. The comparison between the several syntaxes is given in table 1.

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Table 1. The comparison of Inquiry based learning syntax

Sanjaya	Gulo	UIUC	Researcher
Orientation	Problem formulation	*Ask*	Orientation
Problem formulation	the formulation of hypotheses	*Investigate*	the problem formulation
the formulation of hypotheses	Testing tentative answer	*Create*	the formulation of hypotheses
the data collecting	Drawing the conclusion	*Discuss*	the data obtaining
the testing hypotheses	Generalizing and Applying the conclusion	*Reflect*	the testing hypotheses
Formulating the conclusion	Writing the report		Conclusions
			the implementation of the conclusions and generalizations
			the reflection stage

According to that comparison, the researcher uses eight stage of inquiry based learning on this paper. They are the orientation, the problem formulation, the formulation of hypotheses, the data obtaining, the testing hypotheses, conclusions, the implementation of the conclusions and generalizations, and the reflection stage.

3. Research methods

This determines the student's learning difficulties on the each stage. The subject of this research is all of the students in X IPA 4 SMA N Sambungmacan Sragen. The amount of this research subject is thirty students. The method used in this research is descriptive qualitative. The data acquired with the learning process observation, the student's response questionnaire, and the student's cognitive tests.

4. Results and discussion

This research aims to analyze the learning difficulties of students on the material elasticity and harmonic oscillation in the inquiry based physic learning. Data collection of inquiry based physics learning in class X 4 IPA SMA N Sambungmacan by the learning process observation, the student's response questionnaire, and the student's cognitive tests.

4.1. Results of learning process observation

It held by the researcher in the physics lesson on the elasticity and harmonic oscillation material's lesson. Based on the observation of learning process, the researchers find the absence of some learning stage. They are the problem formulation, the formulation of

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hypotheses, the implementation of the conclusions and generalizations, and the reflection stage.

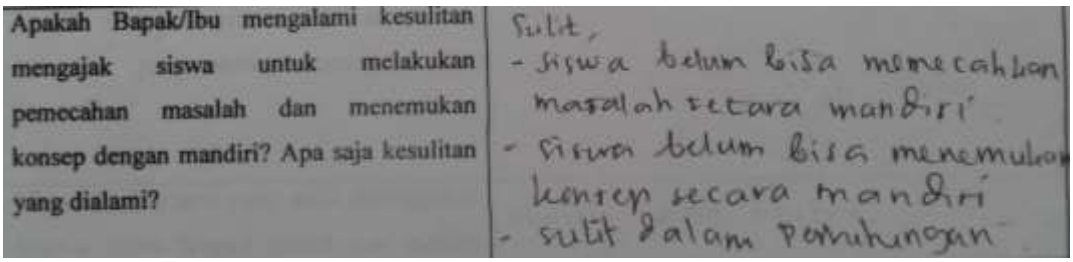

Figure 1. Example observation of learning process

For example, the student has the trouble in solving the problem and finding the concept independently. That result indicates that the testing hypothesis stage didn't apply.

4.2. Results of the student's response questionnaire about inquiry learning difficulties

The questionnaire are given to 30 students in X IPA 4 class.Students have determined the difficulty of inquiry based learning stage and it easily to do. If it is difficult, they choose no, and if those are easy they choose yes. The result of the student's response questionnaire about inquiry learning difficulties are drawn in this example (figure 2).

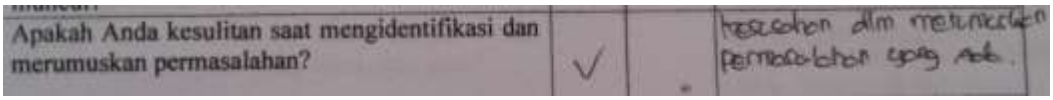

Figure 2. Example result of the student's response questionnaire

The result of the student's response questionnaire, the students have trouble in formulating the learning problem. The difficult stages of the inquiry-based physics learning are the problem formulation, the formulation of hypotheses, the data obtaining, the testing hypotheses, conclusions, the implementation of the conclusions and generalizations, and the reflection stage.

4.3. Result of cognitive tests

Analysis of learning difficulties can be seen from the reached score of students cognitive test. In this research's school, the test score of the student must attain value to get a pass. That value called Kriteria Ketuntasan Minimal (KKM). The physics lesson in the material of elasticity and harmonic oscillation has KKM on 75. If the student's acquisition score exceeds 75, they are a pass. If the score is below than KKM, they not pass.

Some example question in the material of elasticity and harmonic oscillation are drawn in figure 3 and figure 4.

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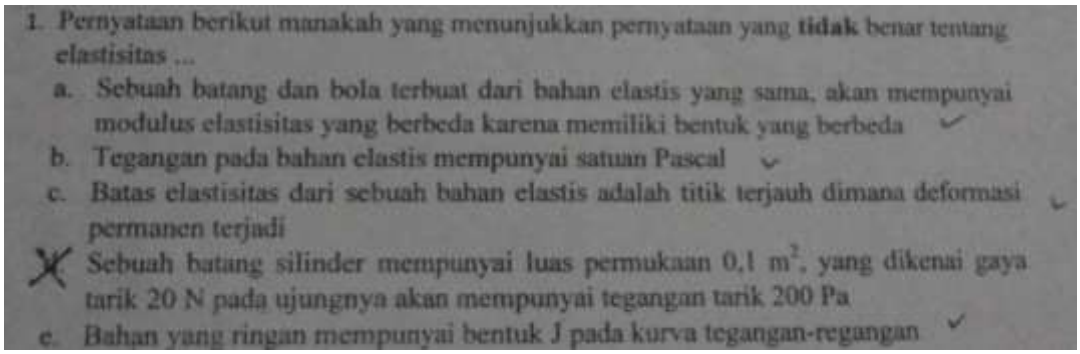
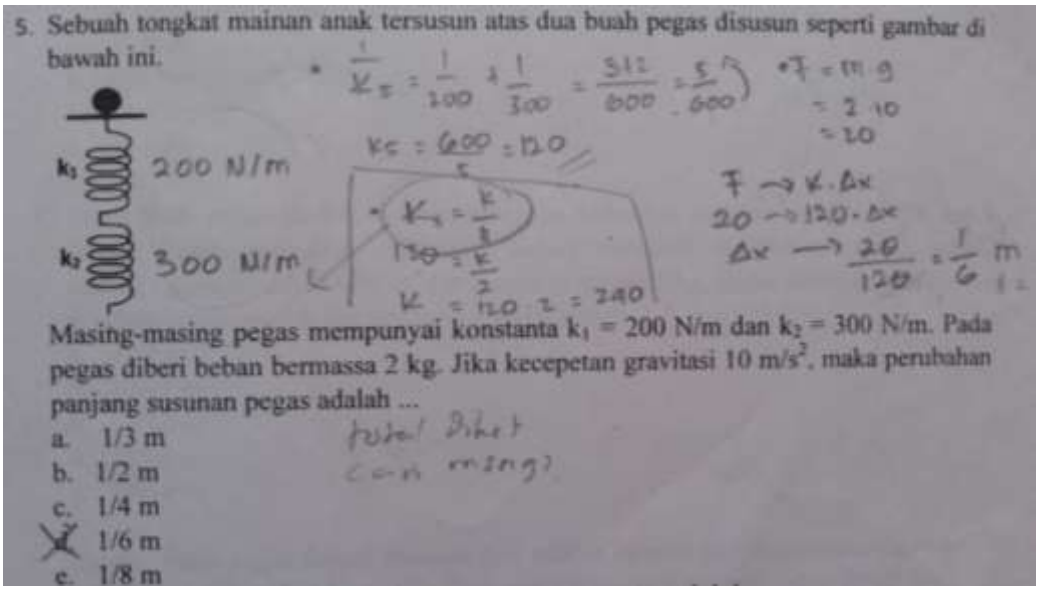

1. Pernyataan berikut manakah yang menunjukkan pernyataan yang **tidak** benar tentang elastisitas ...
   a. Sebuah batang dan bola terbuat dari bahan elastis yang sama, akan mempunyai modulus elastisitas yang berbeda karena memiliki bentuk yang berbeda
   b. Tegangan pada bahan elastis mempunyai satuan Pascal
   c. Batas elastisitas dari sebuah bahan elastis adalah titik terjauh dimana deformasi permanen terjadi
   Sebuah batang silinder mempunyai luas permukaan 0,1 m^2, yang dikenai gaya tarik 20 N pada ujungnya akan mempunyai tegangan tarik 200 Pa
   e. Bahan yang ringan mempunyai bentuk J pada kurva tegangan-regangan

Figure 3. Examples of wrong cognitive test answer


5. Sebuah tongkat mainan anak tersusun atas dua buah pegas disusun seperti gambar di bawah ini.

k_1 200 N/m

k_2 300 N/m

Masing-masing pegas mempunyai konstanta k_1 = 200 N/m dan k_2 = 300 N/m. Pada pegas diberi beban bermassa 2 kg. Jika kecepetan gravitasi 10 m/s^2, maka perubahan panjang susunan pegas adalah ...

a. 1/3 m
b. 1/2 m
c. 1/4 m
1/6 m
e. 1/8 m

Figure 4. Examples of right cognitive test answer

The figure 3 showing that the student has difficulty in analyzing the elasticity concept and the matter's modulus elasticity. And the figure 4 showing that the student can analyze the influence of gravity on changes in spring length.

The result of cognitive test scores has drawn into the following table (table 2).

Table 2. Results of student achievement analysis of cognitive tests based on learning objectives

Learning Objectives	Percentage of achievements	Category
Analyze the elasticity of the spring	60%	Not pass
Analyze the influence of gravity on changes in spring length	77%	Pass
Illustrates hooked law	72%	Not pass
Resolving issues related to hook law	77%	Pass

Determine the materials elastic modulus	57%	Not pass
Explain the application of spring arrangement	80%	Pass
Determine the characteristics of series and parallel arrangement	78%	Pass
Formulate replacement series springs and parallel springs	82%	Pass
Describe the characteristic of motion	75%	Pass
Describes the relationship between the period of oscillation and time	79%	Pass
Analyze the force of deviation, speed, and acceleration	72%	Not pass

4.4. Discussion

The result of this research shows that the student has trouble in almost of the stage of inquiry learning in a physics lesson. The presence of the problem causing by learning process that eliminates some of the inquiry based learning stage. The teacher doesn't give a complete stage in inquiry based learning. The teacher still tries to change the usual learning methods (presentation) to the inquiry based learning method. Therefore, the teacher has difficulties to executing all of the inquiry learning stage.

On the student perspective, the most difficult stages of doing is the formulating hypothesis. In line with the first result, the problem of students in formulating hypothesiss stage caused by the absence of it in the lesson.

The result of cognitive test showing that the student has difficulty in analyzing the elasticity and the force of deviation, speed, and acceleration concept, illustrates hooke law, and the matter's modulus elasticity. The mostly chapter on the material elasticity and harmonic oscillation has been passed by the student, but there is some chapter that student did not pass. It is indicating that the uncompletely inquiry learning must be completed to get the best learning's result.

5. Summary and suggestions

5.1. Summary

Based on this research finding, the conclusion about the inquiry based physic learning in X IPA 4 SMA N Sambungmacan is the student has difficulties in the problem formulation, the formulation of hypotheses, the data obtaining, the testing hypotheses, conclusions, the implementation of the conclusions and generalizations, and the reflection stage. And the student has difficulties in analyzing the elasticity and the force of deviation, speed, and acceleration concept, illustrates hooke law, and the matter's modulus elasticity.

5.2. Suggestions

The difficulties of the student in following the inquiry based learning stage is a problem should be solved. The researcher's suggestion to solve this problem is the provision of learning modules. Learning modules are expected to help the student in following all stage of inquiry based learning.

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Plant vs. Animal, Which is the Most Prefer Understanding of Evolution?

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Abstract. Evolution is one of the main subjects of biology taught in science colleges. Unfortunately, students seem less attention to this subject. In the subject of evolution, the lesson commonly uses the animal as a model to improve the students understanding. The purpose of this study is to compare the ability of tree thinking students who use animals and plants as a model in the evolution lesson. Tree thinking refers to an approach to evolution that emphasizes reading and interpreting phylogenetic tree. This study involved 20 undergraduate students enrolled in the evolution course for biology majors at Universitas Pendidikan Indonesia (UPI). The tree thinking ability of students was measured using Tree Thinking Concept Inventory (TTCI) of Naegle with a little modification. In this test, we analyzed student preferences using animal or plant models using phylogenetic tree diagrams. Results showed that students' TTCI score was higher when using animal models (65.42%) than plant models (55%). These results suggested that students remain to prefer animal models compare to plant models to study evolution. Nevertheless, the use of plants as models can be an alternative to learning evolution in the future.

Keyword : Tree thinking, TTCI, Plant vs Animal, Evolution

1. Introduction

Taxonomy and evolution become the most important part of the curriculum in Indonesia from elementary school to college with various modifications tailored to the intellectual development of students [1]. Many factors cause students to be uninterested in learning evolution; most students assume that evolution is a theoretical lesson material that requires rote so that less attention to students and the process of evolution is difficult to prove the truth. Surveys consistently report low levels of understanding and acceptance of evolution in the United States [2]. Unlike the 32 European countries and Japan, however, the proportion of evolutionary acceptance is higher in the country. The acceptance of evolution is lower in the United States than in Japan or Europe, largely because of widespread fundamentalism and the politicization of science in the United States,one in three American adults firmly rejects the concept of evolution,a significantly higher proportion than found in any western European country. Acceptance is slightly higher among Americans with some college education, with 49%

accepting evolution for plants and non-human animals (but only 22% accept human evolution) [3].

Gibson & Hoefnagels [4] investigated the relationship between introductory biology students' tree-thinking skills and their acceptance of evolution,to determine whether using tree thinking as an organizing framework throughout an introductory-level course can improve students' acceptance of evolution as a valid, scientific theory that unifies a diverse array of empirical evidence and provides a foundation for all areas of biology. The present study identified a significant relationship between students' tree thinking and their acceptance of evolution.

Evolution is a process of nested descent with modification, with lineages diverging from common ancestors and producing the branching patterns of phylogenetic trees [4]. Phylogenetic Systematics is the field of study developed to understand the evolutionary history of organisms, traits, and genes. Tree-thinking is the term by which we identify concepts related to the evolutionary history of organisms. It is vital that those who undertake a study of biology be able to understand and interpret what information these phylogenies are meant to convey [5]. The ability to understand and reason with tree of life diagrams (i.e., cladograms), referred to as tree thinking, is an essential skill for biology students [6]. Tree thinking is the ability to visualize evolution in tree form and to use tree diagrams to communicate and analyze evolutionary phenomena. Tree thinking is essential for developing an accurate understanding of evolution and also helps one to organize knowledge of biological diversity [7].

Novick et al. [8] identified five core tree-thinking skills that are essential for understanding and reasoning with cladograms: (1) identifying characters (i.e., synapomorphies) that are inherited from a most recent common ancestor (MRCA) and shared by two or more taxa, (2) identifying a set of taxa that either do or do not share a specific character, (3) understanding the concept of a clade or monophyletic group (i.e., a group comprising an MRCA and all of its descendants), (4) evaluating relative evolutionary relatedness among a set of taxa, and (5) using evidence of most recent common ancestry to support inferences.

The TTCI (Tree Thinking Concept Inventory) is a multiple choice instrument that measures student s' understanding of phylogenetic trees. TTCI is a measure of concept inventory of the student's answers to the questions that given [9]. The importance of understanding evolution by those who study the origins, diversification and diversity life cannot be overstated [5]. Unfortunately, the theory of evolution that many taught to students more using animal models. In evolutionary learning can use animal and plant models to understand of evolution with phylogenetics diagram.

2. Methodology

The method of the research is descriptive qualitative. The sample in this study was undergraduate student's enrolled in an evolutionary course for biology majors at an Universitas Pendidikan Indonesia (UPI) Bandung, taken by purposive random sampling technique by the reason based on phylogenetics on students' competence. In this study,

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I used the Tree Thinking Concept Inventory (TTCI) modified instrument by [10] are objective test in multiple choice question which in students can select five options in every question and the form of a questionnaire that contains 15 statements as a Non-test instrument to describe a student response tree thinking understanding in the learning of evolution with Yes or No as the selected answers. Data analysis using Microsoft Excel 2013 and software SPSS version 22 following is analysis content validity (TTCI test), question item validity (correlation product moment test), reliability using correlation product moment test, item difficulty level, to know the quality of research instrument.

3. Result and discussion

Analyzed the test result of1.1 using the modified Tree Thinking Concept Inventory (TTCI) to measure student's understanding of phylogenetic trees. On the table below presents the Percentage comprehension levels of Students' Tree Thinking Concept Inventory (TTCI).

Tabel 1. Percentage Comprehension Levels of Students' Tree Thinking Concept Inventory (TTCI) modified by Naegle's (2009)

No.	Sub Concept	Concept Indicator	Percentage	
			Animal models	Plant models
1.	Identifying characters (i.e., synapomorphies) inherited from a most recent common ancestor (MRCA) and shared by two or more taxa	Analyzing characters (synapomorphies) derived from a common ancestor organisms	95%	40%
		Diagnosing characters (synapomorphies) based on kinship descended from ancestors organisms	35%	30%
2.	Identifying a set of taxa that either do or do not share a specific character	Analyzing the relationship of kinship among organisms	70%	65%
		Comparing the phylogenetics tree diagram with two organisms	35%	40%
		Describing the kinship living organisms is determined based on a branching point (node)	50%	55%
3.	Understanding the concept of a clade or monophyletic group (i.e., a group comprising a MRCA and all of its descendants),	Analyzing the relationship of kinship between the Group (clade) of organisms with a common ancestor species and all its descendants.	80%	80%
		Determining kinship among organisms that include sister taxa	55%	15%

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4.	Evaluating relative evolutionary relatedness among a set of taxa	Comparing the two forms of phylogenetic tree diagram orientation of different organisms (rectangular and diagonal) based on evolutionary history	65%	60%
		Identifying the evolution of organisms that show the most primitive among other organisms	75%	75%
		Identifying the evolutionary history of organisms that show the results of the most advanced evolution	90%	100%
5.	Using evidence of most recent common ancestry to support inferences	Studying the evolutionary history of organisms through phylogenetic tree diagram	60%	60%
		Represents the shared ancestor of the lineage of organisms through phylogenetic tree diagram	55%	40%

Based on the data analysis of objective test using the instrument of modified TTCI showed that there are a lot of students who have students greater percentage of the ability of tree thinking using animal models compared to plant models. Figure 1 below shows the percentage of comprehension levels with TTCI as a whole.

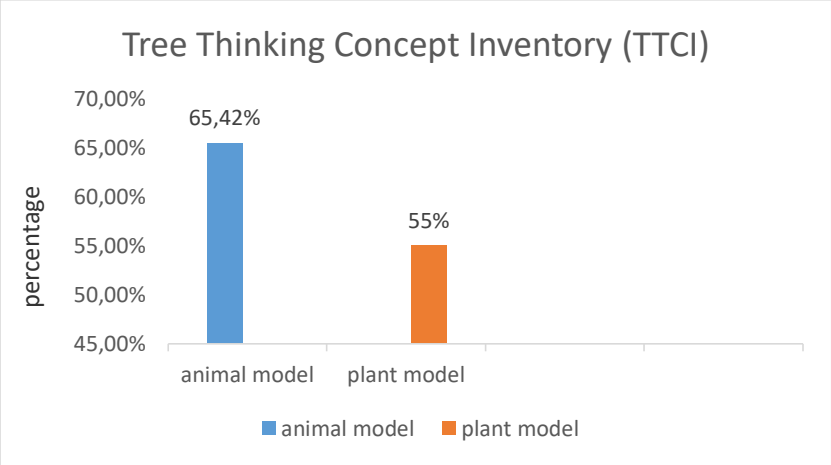

Figure 1. Tree Thinking Concept Inventory uses animal and plants model

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3.1 Identifying characters (i.e., synapomorphies) that are inherited from a most recent common ancestor (MRCA) and shared by two or more taxa.

This outcome requires that a student understand that the tree graphic depicts which characters a given taxon or taxa have and that the character inherited from a common ancestors [11]. According to the table 1, can be seen that concept indicator: Analyzing characters (synapomorphies) derived from a common ancestor organisms and Diagnosing characters (synapomorphies) based on kinship descended from ancestors organisms, show that animal models (95%, 35%) are higher than the plant models (40%, 30%). A learning objective that would go along with this learning objective is to ask students to identify all the characters a taxon from the tree would have. This objective would expand the expectation from the student by requiring them to interpret an entire lineage from beginning to end. Without the ability to interpret which characters have been passed on from common ancestors students are not able to make inferences about the evolution of these characters and taxa, which makes the mapping of characters on a tree uninformative [5]. Students are better at identifying characters using animal models, compared to plant models.

3.2 Identifying a set of taxa that either do or do not share a specific character

Students need to be able to distinguish between characters that reflect natural (based on evolutionary history) groups and those that do not, e.g., convergent characters [5]. According to the table 1, can be seen that three concept indicator. Concept indicator: Analyzing the relationship of kinship among organisms higher percentage of animal model results (70%) than plant model (65%), but 2 other concept indicator that is Comparing the phylogenetics tree diagram with two organisms dan Describing the kinship living organisms is determined based on a branching point (node) Resulting in a higher percentage of plant model than using animal models (40%, 55%).

3.3 Understanding the concept of a clade or monophyletic group (i.e., a group comprising a MRCA and all of its descendants)

So, sub concept above divided into two concept indicators that is Analyzing the relationship of kinship between the Group (clade) of organisms with a common ancestor species and all its descendants and Determining kinship among organisms that include sister taxa. Resulting in a higher percentage of animals model than using plant models (80%, 55%). Understanding the concept of a clade is critical to proper interpretation of groups based on evolutionary history. A monophyletic taxon includes the most recent common ancestor of a group of organisms, and all of its descendants [12] while polyphyletic or paraphyletic groups do not reflect any meaningful history [5].

3.4 Evaluating relative evolutionary relatedness among a set of taxa

According to the table 1, it can be seen that sub concept above is divided into three concept indicator that is: Comparing the two forms of phylogenetic tree diagram orientation of different organisms (rectangular and diagonal) based on evolutionary

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history, Identifying the evolution of organisms that show the most primitive among other organisms, and Identifying the evolutionary history of organisms that show the results of the most advanced evolution. Based on the percentage of TTCI results, the first concept indicator showed the results of the animal model (65%) higher than the plant model (60%), the second concept indicator showed that the animal and plant models produced the same percentage (75%), while the third indicator concept showed the plant (100%) Higher than animals (90%). Based on the above sub concept, students must be able to compare the relatedness of taxa in to make necessary and important biological inferences with evolutionary trees. Evaluating the evolutionary relatedness between species is complicated in multiple ways [5].

3.5 Using evidence of most recent common ancestry to support inferences

Table 1 divides that sub concept into two concept indicator that is: Studying the evolutionary history of organisms through phylogenetic tree diagram and Represents the shared ancestor of the lineage of organisms through phylogenetic tree diagram. The first sub concept shows the model animal model and animal yields the same percentage (75%), while the second indicator concept shows the animal model (55%) is higher than the plant model (40%). Making inferences about character changes or gene function is another valuable tool that evolutionary trees give researchers. This allows mapping characters to the tree and cases of homology and analogy to be distinguished. This has important implications when determining the evolution of a character and taxa [13].

The result shows as a whole that the tree thinking ability of students used animal models (65.42%) is higher than plants model (55%) as shown in Figure 1. These results indicate that the students are higher in value using animal models compared to plants. Because in evolutionary learning, more taught by using animals models, so students are more interested in studying the evolution in animals model, judging by the results of TTCI.

Biological evolution is a difficult concept to learn, as several people at the convocation emphasized. It involves complex biological mechanisms and time periods far beyond human experience. Even when students have finished a high school or college biology course, there is much more to learn about the subject. The difficulty of teaching evolution both complicates and invigorates research on evolution education. To present what is known and not known about the teaching and learning of evolution [7]. So, the tree thinking approach is a process done by using a phylogenetic tree image to help make it easier for students to understand the content of the material [14]. So, phylogenies and tree-thinking instruction can provide tools to bridge the gap between classic historical approaches to teaching evolution and the more traditional emphasis on natural selection and microevolutionary change [15]. However, having students learn about and use phylogenies is not trivial [16]. Students hold several misconceptions that prevent them from using phylogenies effectively and that present “fundamental barriers to understanding how evolution operates [17]. Therefore, in evolutionary learning can use tree thinking approach through a phylogenetic tree to facilitate students in learning

evolution. Can be seen from the results of TTCI, students prefer animal models compared to plant models; teaching evolution in lectures can use this as a reference.

4. Conclusion

This study showed that students remain to prefer animal models (TTCI score= 65.42%) compare to plant models (TTCI score= 55%) to study evolution. The use of plant models, however, must be considered by the teachers or the lecturers to make evolution more understandable.

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