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Depth of Science Learning Materials in Schools and Student Concept Mastery

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Abstract: The depth of science material in schools is related to the teacher's ability to master science concepts. A good teacher is a teacher who is able to compile the concept of science material in a planned manner. Such planning is for example compiling material in-depth or broadly, so that later students are able to master the concept optimally. This article aims to analyze the depth of science learning materials and students' conceptual mastery of the material presented by the teacher. Data were obtained by observing the delivery of concepts and duration used by the teacher and students' mastery of concepts from questions in the form of a description of 6 questions. The sample used is a science teacher and 22 students. The results showed that the teacher conveyed the material not in-depth because there were several concepts with incomplete or separate sub-concepts. As a result, students' mastery of concepts is low even though in question number 3 about the concept of the lithosphere, most of the students on average answered correctly and correctly when compared to the answers to other questions. The high mastery of students' concepts is because the sub-concepts conveyed by the teacher are only mentioned and are not explained in-depth, while the low mastery of students' concepts is because there are too many supporting sub-concepts and the concepts are too deep, thus requiring students' critical thinking skills.

Keywords: Depth of material; Duration; Mastery of concepts; Student concepts.

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Introduction

The depth of science learning material that will be delivered by the teacher is something that must be considered in the learning process. The depth of the material is related to the integration between knowledge and material content (Evens et al., 2018). Both become important for the success of the achievements obtained after the learning process (Susanto, 2020; Taştan et al., 2018). The depth of the material in the science learning process cannot be separated from the teacher designing the learning process well. A good learning process can later improve students' mastery of scientific concepts and attitudes (Mesci et al., 2020).

The level of depth of material presented by the teacher greatly determines student achievement, for example in terms of good content mastery (Cecchini et al., 2020). The research conducted (Mufida & Widodo, 2021) stated that the concepts of simple science material and only in the form of understanding accompanied by examples were very low and not too deep. This is confirmed again by research conducted by (Saclarides & Munson, 2021) which states that low material depth or mastery of concepts can be caused by material content that is not interpreted or explained properly (only explained in general or not explained at all) and not explanation of the content but the teacher conveys difficulties in understanding the content. Based on this, the depth of this material is something that must be considered by the teacher in carrying out the process of teaching and learning activities with students.

The high and low depth of a teacher's material cannot be separated from the mastery of the teacher's concept. According to (Febriyanti et al., 2022) good science learning must have several things, namely mastery of good pedagogical concepts and the second is

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mastery of a teacher's content. Mastery of concepts or content here is mastery of science material content. Mastery of content from a teacher will determine the success of students in understanding the material being taught (Jacob et al., 2020). Students tend to get material that is in accordance with what is conveyed by the teacher. Thus, the material content delivered by the teacher will be more easily understood and applied by students if the teacher is able to construct material content in a coherent, simple and easy to understand manner (Stender et al., 2018).

Mastery of the concept of science material owned by a teacher becomes a challenge in the learning process. According to (Ramadani et al., 2020) mastery of material concepts by teachers in the 21st century is still low and teachers find it difficult to master instruments to convey material to students. Teachers who only come from one book or one source will be too shallow if it is conveyed to students. The findings (Abdurrahman et al., 2019; Lancaster & Bain, 2019) state that teachers must be prepared with fairly extensive material in the learning process. However, the delivery of material to students does not have to be all delivered quite in accordance with the curriculum objectives in the 2013 curriculum science textbooks. science. Therefore, the content of the material in the science textbooks at the junior high school level is appropriate and appropriate to be conveyed to students.

Based on the results of an interview (Sintiawati et al., 2021) to a science teacher, many students do not like physics in science because the concepts are abstract and there are many formulas. As a result, many students who when given the exam produce an average percentage of 50-60% below the minimum completeness criteria. Mastery of students' science concepts is actually related to self-concept (Weber & Leuchter, 2022). According to (Susilawati, 2022) self-concept is a student's point of view or thoughts about material that comes from the teacher or comes from personal experience. This was reaffirmed by (Arafah et al., 2020) that this self-concept will fail if the student does not have more motivation in participating in the learning process, especially in science subjects. One of the motivations of students to be enthusiastic in participating in the science learning process is when the teacher conveys concepts appropriately by mastering the characteristics of learning materials (Suyitno 2022; Widyantari et al., 2021). Thus, this study aims to analyze the depth of the science material delivered by the teacher and the students' conceptual mastery of the lithosphere material in junior high school or equivalent.

Method

This research is qualitative research using descriptive analysis on the data obtained. The data analyzed came from two aspects, namely the first aspect regarding the depth of science material and the second aspect regarding students' mastery of concepts. The sample used was a science teacher and 22 female students in class VII. The topic of the material taught is lithosphere material. The lithosphere material is a sub material of the even semester VII class of the Earth Layer chapter. The depth of the material aims to see how far and how deep a teacher conveys material to students. The following is a flow chart used in analyzing the depth of the content of the material presented by the teacher.

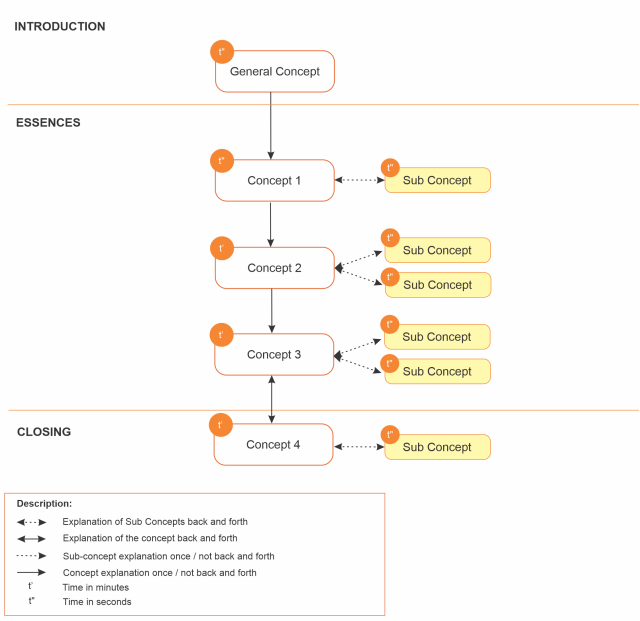

Figure 1. Science material depth analysis flow chart

Teachers who teach in the classroom are observed indirectly. Indirectly, the researcher recorded the learning process that took place in the room. The schools studied carried out the process of teaching and learning activities offline or face to face by following the health protocol so that the process of recording teaching and learning activities in the classroom could be carried out. The results of the video recording will be observed with the concepts conveyed by the teacher to students and then written in the form of a flow chart (Figure 1). This process is very good and effective to use to repeatedly see the learning process carried out by teachers and students in the classroom (Kramer & Kramer, 2020).

The second aspect is students' understanding of concepts. A total of 22 students were given a post test of 6 questions. These questions represent the material presented by the teacher regarding the Lithosphere material. The post test is in the form of a description question. The use of the form of description questions has several benefits, namely the form of descriptions that can measure questions or tasks that are more complex and require answers that must be constructed by the students themselves (the power of reasoning

themselves), so that the possibility of guessing the answers will be fewer or non-existent (Safari, 2019; Qomariya et al., 2018). The post-test result data will be analyzed by calculating the percentage of students' answer accuracy with the available answer keys and made in the form of a graph. It has a function to see the misconceptions between students' mastery of concepts and concepts conveyed by the teacher (Nisa et al., 2022). The form of the description answer will be converted into quantitative data before being converted into a graph by looking at the scale on the rubric that has been made. Thus, the final result of the student's concept mastery data can be seen in the form of a percentage graph.

Result and Discussion

This research focuses on case studies regarding the depth of science material and students' conceptual understanding at the junior high school level or equivalent. The depth of science material focuses more on the process or way the teacher processes science material or content to be delivered to students. Mastery of student concepts is a continuation of the teacher's process of delivering material or the process of evaluating students in teaching and learning activities. Thus, this study obtained data from two aspects, namely the depth of science material and students' mastery of concepts.

Depth of Science Content

Based on the results of research on the depth of science material originating from the process of delivering material from a teacher to students, data obtained in the form of concept titles, sub concepts, duration used in units of seconds and minutes, numbers in brackets indicate the order of delivery of concepts and directions that indicate the series or sequence of teachers. Convey concepts and sub-concepts to students. The following is a flow chart generated from a case study regarding the depth of science material.

The results of the research on the depth of science material indicate that the teacher conveys fewer concepts than the sub-concepts so that the material is not too deep. This can be a weakness in several conditions, such as the findings from (Awang, 2015; Aulia et al., 2018) that the delivery of material that is too deep will make it difficult for students to understand the concept of science material. However, in the same finding, incomplete mastery of the material will also cause students difficulties in understanding the lesson.

In the introductory part, the teacher tends to convey the concept back and forth. The first concept is about the layers of the earth and the second concept is about the atmosphere. It can be seen from the two-way line (Figure 2). These two concepts have no sub-concepts. It is possible that the teacher will only repeat the previous material and the stimulus for the main material to be delivered. According to (Hikmah, 2021) that the initial stimulus for learning is very important because it is the first step to make students focus on the core material to be delivered. This was emphasized by (Akbar, 2021; Musthofa & Sujadi, 2020) that this activity (stimulus) can help students connect past (previous) concepts or also what students get in everyday life with concepts that will be given by the teacher.

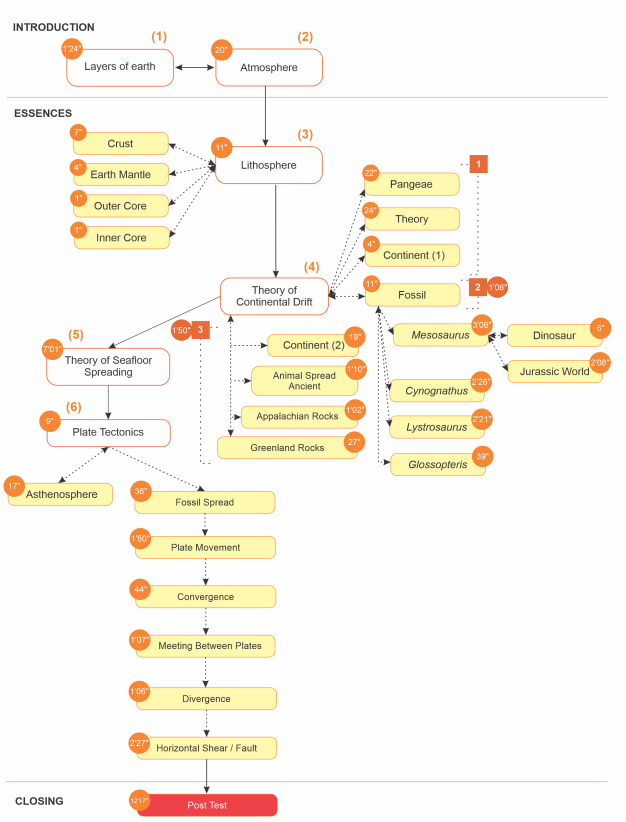

Figure 2. Flowchart of delivering science material concepts

The essence activity section, the third concept of teacher lithosphere tends to only convey the existing sub-concepts without being explained further. This can be seen from the duration contained in the Lithosphere sub concept, which is only 1-7 seconds. Therefore, it will be easier for students to remember it (Ramdani et al., 2020). Especially if students have high motivation in taking science lessons. As in the findings (Humayra, 2018) that grade VII students still have high enthusiasm in learning science because at elementary school the science or science taught is still limited. The process of remembering or memorizing short sentences does not take a long time if students focus. This is a low level of thinking because when students absorb material it does not require a heavy thinking process (Widodo & Iriany, 2021). Based on the explanation above, it is evident that students' mastery of the lithosphere concept including its sub-concepts with a duration of 13 seconds of concept

delivery resulted in a high enough percentage than the others (Figure 3).

The fourth concept of Continental Drift, the teacher conveys fewer concepts than the sub-concepts. Some of the sub-concepts submitted have supporting sub-concepts so that the material conveyed is too far or too broad from the existing concepts, for example in the explanation of the Fossil sub-concept which is divided into four and the Mesosaurus sub-concept which has two sub-concepts, namely the Dinosur and Jurassic World sub-concepts. The explanation of the concept of Continental Drift is divided into 3 sub-concepts. The first sub-concept group discusses Pangea, Theory, and Continents (1). The second sub-concept group discusses Fossils. The third sub-concept group discusses Continent (2), Animal Spread Acient, Appalachian Rocks, and Greenland Rocks (Figure 2). When viewed from the sub-concepts of the concept of Continental Drift, it appears that there is a separate sub-concept of Continents. This causes the explanation of the sub-concept of the Continent to be incomplete. The importance of planning the learning process is one way to make the material intact, such as developing appropriate methods, models, and lesson plans to deliver integrated science material (Priyatma et al., 2019) and teachers must be able to integrate content knowledge into knowledge about the curriculum, learning, teaching, and students (Insani, 2016; Niemelä, 2022).

Explanation of material concepts that are too broad can be made easier in several ways, for example with a concept map made by the teacher as a presenter of material as well as students who can later follow the concept map that has been arranged by the teacher. As researched by (Nurlina et al., 2021) states that sub-materials that are too broad can use a concept map, so that students will be more focused and more easily absorb the material presented by the teacher.

The fifth concept is the Seafloor Spreading. This concept has no sub-concepts but has a long enough time duration compared to other concepts (Figure 2). This long duration should be able to make students more focused on the concepts of the material being taught. Based on the findings (Astalini et al., 2018) that students are more enthusiastic about adding or increasing the time to study science material. This is because the student likes science lessons and the student aspires to become an expert in science so that students will tend to want additional duration of time and can focus on learning science. However, according to (Wahyuli & Ifdil, 2020) the length of the duration of teaching and learning activities can also reduce students' motivation in learning, so that the concepts to be conveyed are not optimal. The decrease in student motivation can be caused because students feel bored and bored.

The concept of Continental Drift with Seafloor Spreading has the opposite difference, namely the teacher is more in explaining the concept of Seafloor Spreading compared to Continental Drift. The difference is probably because the theory of seafloor spreading is less branched for the concepts presented compared to the theory of continental drift, based on the source of teaching materials prepared by the teacher. In accordance with research conducted by (Hadiprayitno & Khair, 2018) that teachers must further mature all forms of equipment and teaching materials that will be delivered to students. In the concept of Continental Drift, there are three sub-concepts that explain the concept so that it looks very broad, not too focused on the initial concept, let alone there are additional supporting sub-concepts that actually don't need to be conveyed. The concept of broad or complex material will make it difficult for students to understand it. Moreover, the material presented is new so that in order to master the material, students must think hard or have at least prior knowledge (Arifin, 2019). Moreover, the demands of students who must understand the concept of integrated science material in a comprehensive or complex manner, students must be able to try to master the concept of the material, of course, by considering the psychological level of the students themselves (Saido et al., 2015; Mufida & Widodo, 2021; Lestari, 2015).

The concept of Seafloor Spreading does not have sub-concepts and has a fairly large time duration compared to other concepts, namely 7.01 minutes (Figure 2). It shows that the concept is quite deep. In-depth material turns out to be a problem for students if the student is slow to understand it. Based on the percentage of students' understanding of the concept of Seafloor Spreading, which is 33.33%, these students have not understood the concept optimally even though the concepts taught are quite deep. This is probably due to several things including students not being given more time to repeat the concept and too much material that must use high thinking skills so that students are not able to process or compile existing concepts. According to (Bahri et al., 2020) states that to be able to make it easy for students to understand material with a high or critical level of thinking ability, it can be seen from the teacher. This is confirmed by the findings from (Usmeldi et al., 2021; Nasution, 2017) that teachers are required to be able to improve their abilities in making innovative, collaborative, and contextual learning models and models. Thus, additional time to repeat the concepts of the material being taught is very important, whether the concepts are taught broadly or in depth. Ice breaking or a break for rest can also be a solution to give enthusiasm and refocus to absorb the next concept (Setyani & Ismah, 2018).

The sixth concept in the core activity is the concept of Plate Tectonics. This concept has two sub-concepts,

namely the Asthenosphere sub-concept and the Fossil Dispersal sub-concept (Figure 2). Asthenosphere sub-concept is a sub-concept having alternating lines. This means that the teacher conveys the concept of Plate Tectonics, then continues with the delivery of the sub-concept of Asthenosphere and returns to the concept of Plate Tectonics. After returning to the concept of Plate Tectonics, then proceed to the sub-concept of Fossil Spread to Horizontal Shear/Fault. There are many sub-concepts that should be the main concept to be explained in this section. According to (Sitohang et al., 2021) that a lot of material needs special activities carried out by students to understand the material such as taking notes, making concept maps, and repeating the material presented.

Closing activity, the teacher does not deliver or provide a review of the material that has been delivered but is immediately given a post test to assess the results of student teaching and learning activities so that later the mastery of the student's concepts can be known. The non-delivery of review material is most likely due to inadequate time allocation (Agustami et al., 2017).

Student Concept Mastery

Based on the results of research on aspects of student concept mastery, in general the average student concept mastery is still below 50% of the 6 questions in the form of description given. This shows that students do not understand the material presented by the teacher. The following is a graph of the percentage results of the analysis of students' conceptual mastery of the lithosphere material in science subjects for class VII.

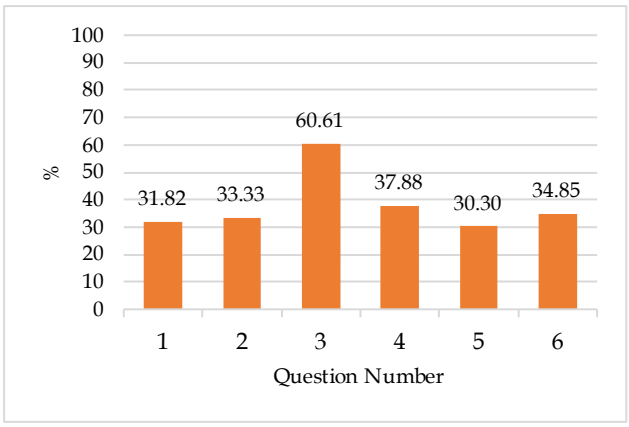

Figure 3. Graph of the percentage of students' understanding of the concept of Lithosphere material

Based on the results of research on aspects of student concept mastery, in general the average student concept mastery is still below 50% of the 6 questions in the form of description given. This shows that students do not understand the material presented by the teacher. The following is a graph of the percentage results of the analysis of students' conceptual mastery of the lithosphere material in science subjects for class VII.

The arrangement of concepts and sub-concepts that will be conveyed to students is also very influential on students' mastery of concepts, for example in question number 6 related to the sub-concept of the Continent (Figure 3). Based on the graph above, it shows that it is easier for students to master the material concepts in question number 3 compared to other questions. Questions number 1 and 2 in general there is no difference between the two resulting in low scores. Problems number 1 and 2 relate to the theory of continental drift and the theory of seafloor spreading. Both have different durations of delivery and quality of material but produce the same low value. According to (Hidayat & Utami, 2020; Sari et al., 2020) high scores are not seen from how much and how long the duration of the material delivered by the teacher but from the motivation of students to focus on following the learning process such as taking lessons with good concentration and recording concepts. the essence conveyed by the teacher.

Furthermore, the concept in number 3 is regarding the Lithosphere (Figure 2). The Lithosphere concept presented by the teacher only mentions the sub-concepts, so that it is easier for students to answer the questions. In addition, the average percentage of students' understanding of the concept of the Continent concept is 34.85%. This is because the sub-concept of Continents is divided into two, namely the first with a duration of 4 seconds and the second 19 seconds (Figure 2). The next factor, this sub-concept is among other sub-concepts that have a longer duration so that students tend to focus on new sub-concepts with a long duration. This learning plan arrangement is an important point in compiling and assembling the concept of the material to be delivered, such as choosing which material to take precedence and which material to end (Chan & Yung, 2018).

Questions number 4 and 5 relate to fossils of ancient (ancient) living things and the theory of Plate Tectonics (Divergent and Convergent theories). Problems related to fossils produce little value even though the duration used by the teacher is more than 6 minutes. This is due to the difficulty of using Latin names for fossils of these ancient living creatures (Suryani et al., 2021; Sofiyan et al., 2020; Amri, 2016). While the questions regarding divergent and convergent students were not too focused because the two words were new terms for them, so students needed additional time or new ways to remember and understand the material easily (WF et al., 2021).

Overall, students are very low in mastering the concept of science material, especially the concept of material regarding the lithosphere. If you look at the results of the flow chart of the depth of science material

in the second picture, it can be seen that the arrangement or sequence of concepts and sub-concepts is irregular. Therefore, giving irregular concepts can be an obstacle for students to understand the subject matter, especially science lessons. This can be seen from the results of research conducted (Crogman et al., 2018) which states that when the concepts received by students are not regular, it will produce scores that are not optimal. Irregular here is the order in which the material is delivered by the teacher. It could be that the teacher is convoluted when delivering the material or the material delivered is not sequential. A good teacher is a teacher who has the ability to process material to make it easier for students to understand. This can be seen from the motivation and communication of teachers in delivering material (Taştan et al., 2018).

Conclusion

The depth of science material and students' mastery of concepts are related to each other. The level of depth of lithosphere material in science subjects is still low. This can be seen from several concepts that are too broad or have many sub-concepts and there are supporting sub-concepts in the supporting sub-concepts. In addition, there are sub-concepts that are not fully or separately explained and have no effect. The arrangement or sequence of delivery of concepts from the teacher is very influential on the mastery of students' concepts. Teachers tend to explain concepts in a non-sequential way. As a result, the level of students' conceptual understanding of the lithosphere material is low. This is because students are not able to process or reconstruct the material properly so as to produce low grades, whether the material is conveyed widely or in depth. Research like this needs to be done on the same research object for different topics, for example, done in other schools or other science materials.

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