Visual reading strategies and its relation to plant morphology comprehension of senior high school students

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Abstract. One of several factors that influence students' successfully to understand the various concepts contained in the diagram is the use of effective visual reading strategies. The results of previous studies prove that students' comprehension of the diagram is still low, although diagrams are often used to facilitate students in understanding concepts. This was a descriptive study involving 20 high school students in Bandung. The research aims to analyze the relation between visual comprehension strategies and students comprehension toward plant morphology diagrams. The students were asked to analyze the morphological diagram of magnoliophyte plants for 15 minutes. The strategies emerge from students will be analyzed and categorized into low-level strategies, high-level strategies, and metacognitive strategies. Then the students will be given questions to measure the level of comprehension after learning a morphological diagram of magnoliophyta plants. The results showed that many students did a more low-level strategy that tends to memorize, to reread diagrams, and to text signaling. It suits to the level of student’s comprehension about plant morphology that is still in the low category. The outcome shows that knowledge of plant morphology possessed by high school students was still at the level of memorization.

1. Introduction
The diagram is a visual media that is often included in textbooks and has an important role in the learning process. However, many studies reveal that many students fail to understand or interpret scientific concepts contained in diagrams [1,2]. In science, especially Biology lessons, diagrams have an important role in explaining complex concepts. A study revealed that students' comprehension of plant diagrams was still low. This is evidenced by the small number of students who have high comprehension. Based on that research, only found 28% of students who have high comprehension while the rest are still in the medium and low category [3].

The low comprehension of students when studying diagrams can be influenced because students don't use many visual reading strategies [4,5]. Visual reading strategies are sets or sequences of multiple cognitive activities that are assumed to determine students' success in understanding diagrams [4]. Knowledge of visual reading strategies is very important for teaching because it can be applied to develop teaching aids that specifically meet the needs of students relating to pictorial information on
learning topics that are difficult and complex or sometimes even poorly designed [4]. Therefore a visual reading strategy is needed to facilitate students in understanding the diagram.

Visual reading strategies are categorized into three levels. These levels are low-level strategies, high-level strategies, and metacognitive strategies. Low-level strategies consist of cognitive activity not thinking, memorize, highlighting information, rereading diagrams and text signaling. High-level strategies include activities coordinating informational sources, redraw, imagery and summarizing. The last is the metacognitive strategies includes activities of the feeling of knowing, judging of learning, monitor of use the strategies, declaring difficulty tasks and task ease [6].

Nowadays, diagrams or pictorials information in learning is very important. In addition, that research that focuses on visual reading strategies when students learn pictorial information is still rare [4,5,7]. therefore, visual reading strategies and its relations to plant morphology comprehension in high school students’ are object on this paper.

2. Methods
This research was descriptive research. The visual reading strategies that emerged were calculated using an observation sheet scheme adopted from Cromley’s study [4]. Comprehensions data of students was calculated using cognitive levels that refer to Marzano’s taxonomy [8]. Data on the relation of visual reading strategies and comprehension of students are analyzed and presented in descriptive form.

Twenty students were involved as participants in this study. Sampling is taken by the convenience sampling method. The participants were students in one of the private senior high schools in Bandung consisting of ten and eleven grade.

The instrument used in this study was the visual reading strategies observation sheet adopted from Cromley’s research [4] which is categorized into three levels, including low-level strategies, high-level strategies, and metacognitive strategies. Furthermore, data on students comprehension was measured using test questions compiled based on Marzano cognitive taxonomy which included the ability to integrate, match and analyze [8].

In the first stage in this study, students were given a morphological diagram of the Magnoliophyta plant. Then the observer instructs students to understand the diagram for 15 minutes. When students study the diagram, video recording is carried out to easier for analyzing each strategy that appears from students. To collect comprehension data, students were given a written test about the morphology of the Magnoliophyta plant. Furthermore, data on visual reading strategies and student comprehension were collected and then was analyzed both relations.

3. Result and Discussion
3.1. Visual reading strategies
The results of research on the three level of strategies calculated on students when studying the morphological diagram of the Magnoliophyta plant shows that low-level strategies that appear are not-thinking activities (15%), memorize (90%), highlighting information (25%), Text signaling (70%) and rereads teks or diagram (75%). Based on five categories of low-level strategies, the most frequently used by students when reading diagrams is 90% memorize activities. Meanwhile, as many as 15% of students do activities not thinking when studying the diagram. This was obtained from interviews because they were less interested in plant topics. The results of low-level strategies can be seen in Figure.1 below.
In Figure 1, the memorizing strategy appears so much that it allows students to feel difficult in understanding complex diagrams. This is evidenced by the findings in the field which show that students find it difficult to understand the diagrams in the context of monocot and dicotyledonous leaves which tend to have many of the same shapes. Additionally, strategies such as rereads text or diagram and text signaling are also included in ineffective strategies in understanding diagrams [9].

In the context of this research, strategies elaborate into high-level strategies. The elaborating strategies in which there are analogous activities can be used by students to process information to be more meaningful even in relation to linking prior knowledge with new information acquired to be stored in long-term memory [10].

The metacognitive strategies show little appearance in all categories. On the strategy feeling of knowing (5%) and judging diagram adequacy (5%). meanwhile, in the activity of monitor the use of
strategy and declaring the diagram difficult or easy, it does not show emergence when students study
the diagram. This is because the metacognitive strategy is still not possessed by high school students.
This is what allows the rare emergence of metacognitive strategies at the high school level because
metacognitive knowledge is a cognitive level that is at the highest hierarchy in the knowledge dimension
[11].

3.2 Students’ Comprehension
The results of the study showed that students’ understanding after studying the morphological diagram
of the Magnoliophyta plant did not show a high value. The percentage of students’ comprehension values
can be seen in Figure.3 below.

![Figure 3. The percentage of comprehension score](image)

In Figure.3 it can be seen that the ability to integrate and match the students with the same score as
the percentage of 57%. While the score on the ability to analyze errors is a percentage of 52%. Based
on the graduation standard value which is at 60% in Biology subjects at senior high school, it can be
said that all these students have not been able to pass on the topic of plants.

3.3 The Relation between visual reading strategies and students’ comprehension
Based on results the relation Between Visual reading strategies and students’ comprehension in senior
high school students when studying the morphological diagram of Magnoliophyta, it shows that students
still have a low comprehension. This condition can be caused by many students who use low-level visual
understanding strategies such as memorizing, rereads text or diagram and text signaling. Previous
research also stated that low-level strategies such as rereading and underlining text did not contribute
greatly to good comprehension [12]. When students use more memorization and reread strategies, it
greatly influences the understanding of the ability to integrate, match and analyze because memorizing
strategies tend to only be able to record what they see so that it is difficult to understand other pictoral
examples. Another factor that can lead to low student understanding is that some teachers do not master
the topic so they only read what is in the book [13]. This can be one of the factors that influence students
in using strategies with memorizing abilities.

The results of the understanding data also has shown to students who use a lot of high-level strategies
when understanding the diagram shows better results, because at that level students have the ability to
coordinate text with images so that they have more advantages in understanding a diagram [14].In
addition, students must also be able to internalize concepts, relate them to what they know, summarize
their own words throughout the sentence, and actively draw conclusions between information to
effectively learn from the text about complex topics which are all one use of strategies that are good at
understanding [15,16].
Table 1. Spearman’s correlation test between visual reading strategies and comprehension

| Variable                        | Visual Comprehension Strategies | Comprehension |
|---------------------------------|----------------------------------|---------------|
| Visual Reading Strategies       | 1                               | 0.479*        |
| Comprehension                   | 0.479*                          | 1             |

In table 1, it can be seen that the relation between the visual reading strategies and students' comprehension shows the correlation is categorized as being positive with a correlation coefficient (r) of 0.479*. This shows that there is the relation between two variables which confirms that more and more visual reading strategies when students study the diagram relate to the high level of student understanding.

4. Conclusion
Based on the results of research on twenty senior high school students in Bandung, it is known that students still have a low comprehension of plants. The students tend to still use memorizing strategies and reread text or diagram when understanding plant diagrams. From these results, it can be concluded that what is taught by teachers at the high school level is still at the level of memorization so that when students are given with different images or diagrams in the same context, students cannot afford to solve them.

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