Undergraduate students ability to process information and its relation with visual and verbal representation in plant morphology laboratory activity

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Abstract. Laboratory activity of plant morphology requires students to process the information of specimen in their working memory and then represent it both visually and verbally. The aim of the study is to describe the relation between the student’s ability of information processing and their visual and verbal representation in plant morphology laboratory activity. This study was conducted in one of the state univercities in Bandung Indonesia, in the class of pant morphology course with 31 students. Student’s ability of information processing was assessed by using task complecity which consist of component of information, integration of information, and application of information. The visual representation was analyzed based on authenticity and the detail of picture, propotional of picture, and suitability of the picture with the concept. The verbal representation was analyzed by the suitability of the description with the concept, completeness of the description, clarity of the description, terminology, and binominal nomenclature. The result shows that the student’s information processing ability has low correlation with visual and verbal representation ability. Based on the result, we can say that student’s with a good information processing ability can’t always show that they have a good visual and verbal representation ability as well.

1. Introduction

Plant morphology is a foundation in the faithful of botanical investigations [1]. Therefore, in the lectures of plant morphology students are specifically directed to be able to understand the basic concepts and knowledge about the scientific terminology of plants through classroom learning activities and equipped with direct observation of real specimens to obtain factual knowledge through laboratory activities. Factual knowledge is obtained in the form of information about specimens to be processed by an information processing system (working memory) that can be stored on the system of long term memory [2].

Information obtained during the observation of macroscopic objects can be represented verbally and nonverbally in the form of visual representation. Visual and verbal representation serves as the bearer of meaning. Visual representations in biology include various types, such as photographs, images, maps, diagrams, graphics, tables, equations, and text [3]. One of visual representation that can be used to represent objects in the practicum of plant morphology is the image. Images are visual representations that describe all types of content, both structures, relationships and processes created in the form of static two dimension on any media [4]. The image representation can present...
information about the understanding of the object phenomenon observed with respect to the concept being studied. An image representation made by a students can explain the student’s understanding of the learned concept [5]. While the verbal representation is a representation that contains the code or terms of visual information. Such codes or terms may be expressed in terms of words and / or descriptions supporting the visual information obtained [6].

The result of the specimen representation made by the students can describe the student’s degree of observation on the specimens observed, but in representing the result of visual representation in the form of student’s description also still having difficulties. This is due to the morphology of plants, especially on the pattern of branching patterns of stems there are many morphological-based terms that are difficult to understand by the student. These terms are the basis for observation activities and descriptions so that when observing the practicum object causes the students difficulties in observation activities, so that students also have difficulty in obtaining information. Based on the problem, research is done to analyze the student’s ability in processing information and its relation with the students' visual and verbal representation ability on plant morphology practical activity about the pattern of branching stems.

2. Method
This study was conducted in one of the state universities in Bandung Indonesia in the even semester of academic year 2017/2018, in the class of pant morphology course with 31 students. Participants of this study were 31 students who contracted the lectures of plant morphology with the weight of 2 credits lectures. This study was conducted on the pattern of branching rods. Student’s ability of information processing was assessed by using task complexity which consist of (1) component of information, (2) integration of information, and (3) application of information [7]. The visual representation was analyzed based on (1) authenticity of picture, (2) detail of picture, (3) propositional of picture, (4) suitability of the picture with the concept [8]. The verbal representation was analyzed by (1) the suitability of the description with the concept, (2) completeness of the description, (3) clarity of the description, (4) terminology, and (5) binominal nomenclature. Student’s ability of information processing and represent specimens both visually and verbally can be grouped according to table 1.

<table>
<thead>
<tr>
<th>Score interval</th>
<th>Category</th>
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<tbody>
<tr>
<td>80-100</td>
<td>Excellent</td>
</tr>
<tr>
<td>60-79</td>
<td>Good</td>
</tr>
<tr>
<td>40-59</td>
<td>Adequate</td>
</tr>
<tr>
<td>20-39</td>
<td>Inadequate</td>
</tr>
<tr>
<td>0-19</td>
<td>Very Inadequate</td>
</tr>
</tbody>
</table>

3. Result and Discussion
The data of the study about the ability student’s information processing on the material of branching pattern is analyzed based on the answer of task complexity done after the observation about the a-pattern of branching stem, the students score in information processing is presented in figure 1.
Figure 1. shows that most students have the ability in information processing on the bifurcation pattern material. The information processing includes categories of information components, information integration and application information. The percentage of data processing capabilities based on these categories is shown in Figure 2.

Figure 2. shows that 65.83% students can process components of the information obtained from the observation specimen of patterns of branching stems. Although students can process the information components of specimens well observed, students are still struggling to integrate and apply the components of the information they have acquired. This can be because the information component that has been processed is not fully processed at the time of processing the information so it is not stored in long term memory, then when recalling these components to be integrated into an information there will be missing components. The existence of missing or uncomplicated components makes it difficult for students to integrate and apply the information that has been obtained [9].

Information that has been processed in working memory will be stored in long term memory that involves cognitive activity so that information can be recalled to be represented [10]. Cognitive activity based on dual coding theory is a process involving two different subsystems, namely verbal system and nonverbal system [6]. The verbal system deals with language, both oral and written. Meanwhile, the nonverbal system focuses more heavily on the visual system relating to images of nonlinguistic objects or events. Both systems consist of internal representation units that are activated when one sees, observes, recognizes, manipulates, and or thinks words or objects [10]. Likewise, cognitive activity occurs during the practical activity of plant morphology, students will observe
specimens to obtain information which is then processed in working memory and stored in long term memory so that it can be represented both visually and verbally. The students' ability to represent specimens of visually observed branching stems is presented in the form of drawings and verbally in the form of descriptions can be seen in figures 3 and 4 below.

Fig. 3 and Fig. 4 show that the student’s ability to represent specimens of branched tree patterns observed both visually and verbally are in good category. When connected with students' ability to process information about the branching pattern of the rod shows that the percentage of all-students who have the ability to process information being greater than the percentage of students who have the ability of being in visual and verbal representations. In addition, statistical test of the relationship of student’s ability to information processing on laboratory activities of stems branching patterns with the ability of students to represent visually and verbally presented in Table 2.

**Table 2.** Result of correlation test of student ability in processing information with visual and verbal representation on laboratory activity of branching pattern of stem.

<table>
<thead>
<tr>
<th>Correlation Value</th>
<th>Aspect</th>
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<tbody>
<tr>
<td>0.963</td>
<td>Visual and verbal</td>
</tr>
<tr>
<td>0.444</td>
<td>MMI with visual and verbal</td>
</tr>
</tbody>
</table>
Table 2. shows that the student’s visual and verbal representation ability on the laboratory activity of branching patterns of stems has a significant correlation of 0.963. While the ability of students in information processing with the ability of visual representation and verbal in practice the branching pattern also has a correlation with a low correlation of 0.444. This shows that the ability of representation is not always related to the ability of students in information processing which is a cognitive activity that involves working memory and longterm memory. A visual representation made by students can explain the student’s understanding of the information obtained based on learned concepts, while the verbal representation is a representation containing the code or terms of visual information [5]. The ability to represent both visually and verbally is not only related to the ability to information processing that involves cognitive activity, but the ability of representation is also related to psychomotor activity that is influenced by several factors.

One of the factors that affect the student’s ability to represent the specimens is the experience and skills related to the image and description [4]. So a student who has the good ability of information processing can not always show that the students also has good visual and verbal representation capabilities. Factors that also affect the student’s ability to represent specimens are the student’s perspective on images and descriptions. Students who like to draw and write and have good drawing and writing skills but believe that drawing is something that should be done in the art class and making the description is something that should be done on the language and literature classes so the students will not enjoy the representational activity. In addition to not enjoying the representational activities undertaken, students with such views will also not be motivated to perform such representations [4]. This shows that students who have the ability to process good information can not always be described with the ability to represent the information both visually and verbally.

4. Conclusion
The result shows that the student’s information processing ability has low correlation with visual and verbal representation ability. Based on the result, we can say that student’s with a good information processing ability can’t always show that they have a good visual and verbal representation ability as well.

5. Acknowledgments
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6. References