The influence of concept maps and visuospatial representations to students achievement and creativity on plant anatomy courses

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The influence of concept maps and visuospatial representations to students achievement and creativity on plant anatomy courses

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Abstract. Concept maps used to understand the concept of plant anatomy, and visuospatial representations are used to create 3 dimensions the imagination concept from two dimension images to 3dimension concrete. That is can improve creativity. The purpose of the research was to know the effect of a concept map and visuospatial representation to the students achievement and creativity on plant anatomy courses. Method of this research was correlational, the sample was the biology perspective teacher students who take plant anatomy courses amount of 34 students. A deductive approach was used in learning and used Wimba model learning as a learning model based on visuospatial. Data collecting used concept map rubric plant anatomy test, visuospatial assessment and creativity. Data processing was multiple regression test. The result shows that simultaneously concept maps and 3D representation have a very significant effect on students achievement and creativity. The conclusion was the concept mapping and 3D representation effective to improve students achievement and creativity.

1. Introduction

The concept of maps is made through a constructivist approach. In this case, the concepts are used to form new concepts in the mental process. The results strongly support that when students are taught to use both teaching strategies for concept maps and traditional teaching strategies, they achieve the best score [1]. Research shows that using concept maps shows a greater influence on academic achievement [2,3].

Concept mapping can help them to understand, integrate and clarify accounting concepts and also enhance their interests in learning to account. Concept maps are that it is a visual way. Concept mapping assists in meeting and adhering to the general educational goals of learning programs, which is support learners to be academically successful of communication, Concept maps can also be used to reflect on the effectiveness of learning programmes [4]. There is support for further investigation of using concept mapping for creative development [5].

Creativity was operationalized using dimensions of novelty, interest, clarity, and ability to be understood. A multivariate effect of planning method was found for these dimensions favouring the concept map group, due largely to greater clarity in the photo stories [6]. But there are a number of theories about the underlying mechanisms of creativity, theories attributing it to everything from method to madness none of them very satisfactory. As to inducing creativity by using heuristic strategies or through "creativity training" this has had very limited success [7]. Deductive reasoning, which is defined

as reasoning from general principles to particular cases is in general not creative., but not all deductions are trivial; some may well require formidable creativity to accomplish [8].

Wimba learning model is a visuospatial-based learning model, which is required to be able to represent concepts or observations in a 3D dimension [9]. 3D representation starts from microscopic observation, then does the representation of concepts in the form of 2D images to develop 3D. Visuospatial-based learning can improve the learning outcomes of plant anatomy and creativity for prospective biology teacher students [10,11].

Plant anatomy subjects are known to be static but develop into dynamic after using the Wimba learning model [11]. Students made representations of 2D dimensions (2D) and 3D dimensions (3D) of the cell and plant tissues structures using playdough media or using the 3DsMax software. This representation activity can develop students 3D imaginative abilities so that they can improve spatial abilities and support creativity [11]. Kell et al. mentions the findings indicate that spatial ability has a unique role in the development of creativity [12]. Visuospatial representation using the model wimba has a role in improving students conceptual mastery of the human urinary system through the involvement of imagination and visuospatial abilities [13]. The spatial ability not only plays a unique role in assimilating and utilizing existing knowledge but also plays a unique role in developing new knowledge [12]. The purpose of the study was to determine the effect of concept maps and visreps on learning outcomes and creativity on visuospatial wimba-based learning models.

2. Research method

Method of this research was correlational, the sample was the perspective of teacher students who take plant anatomy courses amount of 34 students. Learning approach is used deductive, that is, starting with lectures in class and then continuing with lab work. The map concept is created as an individual task before the learning process in class, then discussed in class in the class. Concept maps are made so that students understand the concept of lecture material. Assessment of concept maps based on the number of meaningful proportions made, hierarchy and crosslink rubric [14]. Concept maps have been made very well by students, with an average score of 94. By making concept maps, students understand the concepts learned. Lab work is carried out after concept discussion in class. Students make microscopic observations of the preparations they make. The results of microscopic observations, they are images (2D representation) then students design 2D images into 3D images. Then they were asked to make 3D using 3DsMax software. Visuospatial representations assessment is a modification of [15], consisting of the form of network/organ, cell form, proportionality, differentiation, and location. Whereas student learning outcomes were measured using the test results of studying plant anatomy in the form of a validated double test. Learning outcomes are processed using N-Gain assessment [13]. Creativity is measured using TCIA (Test of Creative Imagery Abilities) tests [9]. Data processing is used multiple regression test with SPSS.

3. Result and discussion

3.1. Result

The results showed that students were able to make concept maps very well with an average of 93.94, this indicates that students have understood the concepts learned. While the microscopic visuospatial representation shows a moderate number, which is 43.38. Learning outcomes also show a moderate category, which is 0.47 [13]. The resulting creativity shows an average of 10.91, good category (max 14 values) (table 1).

Table 1. Result of research.

	Mean	Std. Deviation
Concept Map	93,94	24,16
Visuospatial Representation	43,38	10,693
Students achievement (N-Gain)	0,47	0,165
Creativity	10,91	2,575
Valid N (listwise)		

Correlation test of concept maps and visuospatial representation on learning outcomes carried out statistical tests using multiple regression. The results of the data processing showed the correlation between concept maps and visuospatial representation on students achievement included in the strong category with R = 0.427. These results indicate that there is a strong correlation between concept maps and visuospatial representation against students 'achievement. Also obtained is R^2 (determination) = 0.182, which means that there is a contribution of 18.2% concept maps and visuospatial representation to students 'achievement. Statistical test results using multiple regression also shows the double regression equation is:

$$Y = 0{,}022 + 0{,}003\ X_1 + 0{,}004\ X_2.$$

The equation also shows that partially, both concept maps and visuospatial representation have a significant correlation with learning outcomes. ANOVA test was used to find out the significance of the influence of concept maps and visibility against students achievement. The results showed that together/simultaneously concept maps and visuospatial representation had a very significant effect on learning outcomes. This is indicated by the significance value of the calculation of 0.049 which is smaller than the significance level used which is 0.05.

Correlation test of concept maps and visuospatial representation on creativity performed statistical tests using multiple regression. The results of the data processing show the correlation between concept maps and visuospatial representation on creativity are included in the strong category with R = 0.416. These results indicate there is a strong correlation of concept maps and visuospatial representation against creativity. Also obtained is R^2 (determination) = 0.340 which means that there is a contribution of 34.0% concept maps and visuospatial representation to creativity. Statistical test results using multiple regression also shows the double regression equation is:

$$Y = 13{,}075 + 0{,}004X_1 + 0{,}006X_2.$$

The equation also shows that partially, both concept maps and The equation also shows that partially, both concept maps and visuospatial representation have a significant correlation with creativity. To find out the significance of the effect of the concept maps and visuospatial representation against creativity carried out ANOVA test, the results showed that together/ simultaneously concept maps and visuospatial representation had a very significant effect on learning outcomes. This is indicated by the significance value of the calculation of 0.006 which is smaller than the significance level used which is 0.05. The conclusion of the statistical test results shows that the concept maps and visuospatial representation simultaneously have a very significant effect on students achievement and creativity.

3.2. Discussion

Concept maps are a good enough tool for knowing students understanding of the concepts being studied. The activity of creating concept maps aims to establish the concept of lecture material. Students must read references to determine important concepts. Students try to transform from important concepts into concept maps by making propositions, complemented by conjunctions. If students do not understand the concept, students are unable to make propositions on concept maps. The results of the concept map are discussed during classrooms and the results are good.

Practicum carried out by students through microscopic observations of the structure of cells, tissues, and organs of plants, makes students recognize the concepts previously learned to be real. Microscopic observations have connected the concepts theoretically to real concepts. The task of making 2D images from microscopic observations makes students observe in detail the shape of cells and cell structures and plant tissues. 3D design created by students is an activity to change image 2 D into 3D involving imagination and mental processes. This activity is the act of changing one representation into another. Creating 3D makes students able to recognize the structure of cells, tissues, and organs of plants as well as the relationship between their structure and function properly. Students are able to create 3D cells, tissues and organ plants very well and well, but some students are still not good. Some students still have trouble making 3D representations well. This constraint is caused by the low representation ability

of students, so they are not able to make 3D representations or are less skilled in using 3DsMax software, so it is difficult for them to create visuospatial imagination. Representative skills are essential for understanding disciplinary content while completing assessment task routines that require students to translate between representations or superiors of multiple representations simultaneously to produce solutions [16,17].

Referring to the results of data processing with statistical tests showed that concept maps and visuospatial representation contributed 18.2% to learning outcomes, and 34% to creativity. This shows that concept maps and visuospatial representation both contribute to learning outcomes and creativity. The contribution is quite good, but there are still opportunities for improvement. The weakness of this research is that the concept map task is made as homework, there is a possibility that some students do not work according to the provisions, so there is no mental process when working on the concept map.

The deductive method is used in a large classroom setting while the inductive method is effective when used on small groups or numbers of students [18]. In the deductive approach, concepts that have been learned during lectures make it easier for students to make microscopic representations when practicing. The results showed that the concept map and the ability of Visuospatial representation had a very significant effect on learning outcomes and creativity. These results provide good hope for developing a Wimba learning model based on visuospatial so that the learning of plant anatomy courses becomes dynamic.

4. Conclusion

Concept and vision maps have a very significant effect on learning outcomes and creativity. Concept maps and visuospatial representation contributed 18.2% to learning outcomes and 34.0% to creativity. This shows that learning plant anatomy using the Wimba model is very useful and can improve learning outcomes and creativity.

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