LEARNING THROUGH A MODULE BASED ON CONSTRUCTIVISM IN RECONSTRUCTION EFFORTS IN THE CONCEPT OF PLANT CELLS

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Abstract

Misconception and alternative conception of plant cell is a problem often occurred within student. Misconception is a mistake in understanding concept. While alternative conception is a state which concept is less accurately studied. These cases often felt by student and caused by several factors. One of the factors is mistakes in absorbing information about concept being learnt. Therefore, it is necessary to seek effective learning strategies to overcome the misconception problems. This research's objectives is conducted to answer a question whether constructivism module based learning is effective in constructing plan cell concept and studies improvement. This method used in this research is design experimental, one-group pre-test and post-test. The research subject is 80 students at senior high school in Greater Aceh district, Aceh, Indonesia. The research is conducted for three months from February to April 2018. Parameter measured is reconstruction concept ability and improved studies result. Concept reconstruction measuring three aspects; reconstruction occurrence, understanding and not understanding. Studies improvement is measured with calculating gain normalization (n-gain). Instrument used is constructivism module based and test objective with CRI answer sheet. Data collection is conducted through both pre-test and post-test. Data analysis for reconstruction ability concept is conducted with percentage while to compare the improvement of study result is tested with two average test using one sample t-test. Research result shows concept understanding ability increase 54.56%, not understanding reduce to 44,44% and misconception decrease to 10.33%. Result of t-test also shows significant differences between pretest score (initial ability) and n-gain score (last ability) at a significant rate of 95% (α=0,05). The result conclusion is that learning through constructivism module based is effective in increasing reconstructive ability concept of plan cells and improving studies result.

Keywords: Module, Constructivism, Reconstruction, Cell Concepts,

1. INTRODUCTION

Misconception and alterative conception regarding plant cell concept is a problem that often occurred within student. Misconception is a process of wrong concept understanding while alternative concept is less accurate concept understanding (Xiabao 2006; Ibrahim, 2012). This phenomenon often occurred within student due to several problems. One of the factors is mistake in gaining information regarding concept

being learnt by student. Students used text book published by various publisher as reference to learn Biology concept. Research has found that these text books have its own way in providing the concepts (Adisendjaja, 2017). This condition generating misconception as well as alternative conceptions among students. Most of the misconception occurred in fundamental concept of structure, cell function, diffusion, osmosis and cell chemistry substance (Mahardika, 2014).

Misconception and alternative conception among students need to be minimized as soon as possible as misconception and alternative concept will lead to misunderstand the concepts. To fix misconception and alternative concept within student is not a simple work. Solution need to be seek to help student to overcome this problem and to reconstruct correct concept understanding which initially wrong. One of the solutions to solve misconception and alternative conception is by re-work the existing strategy. Teacher as the main role in learning process is expected able to choose method, approach, strategy and media that are effective enough to tackle misconception and alternative conception problem within students.

Other obstacle in handling misconception and alternative conception is science teacher limited knowledge in understanding Biology concepts. More than 50% of 80 science students understand cell concepts as alternative conception (Muhibbuddin, 2015). Moreover, limited books can be used as a standard reference in learning plant cell concepts. Research has been done to identify and solve alternative misconception and misconception (Adisendjaja, 2017; Arslan, et al., 2012; Antink-Meyer, & Meyer, 2017; Christianson & Fisher, 2010; Hasan et al., 1999; Haslam & Treagust, 2010; Kao, 2007; Karpudewan et al., 2014; Kumandas et al., 2018; Mahardika, 2014; Potgieter et al., 2010; Taber & Tan, 2010).

However, research that particularly related with learning process to solve misconception and alternative conception is limited. There is few research has been done toward learning strategy based on constructivism implementation to solve misconception and alternative conception (Baviskar et al., 2009; Evergreen et al., 2016a; Evergreen et al., 2016b; Imamah, 2012; Kleickmann et al., 2013; Tang et al., 2012; Yustina & Kapsin, 2017). That research stated that constructivism learning process contributes toward student good concepts understanding. However, the effect of this method toward concept reconstruction ability remains answerless question. This research is conducted to find out how effective constructivism module based learning process toward reconstructing plant cell concept and studies result improvement.

2. RESEARCH METHOD

Method used in this research is experiment method with design one-shot case study (Gall et al., 2003). Research design is as below.

Table-1: Experimental one group pre-test post-test design

Group	Pretest	Treatment	Post-test
Treatment Class	O_1	X	0_2

X = Learning with module based on constructivism
O_1 = Pre Test (before treatment)
O_2 = Post Test (after treatment)

The research subject is 80 senior high school students in Greater Aceh district, Aceh, Indonesia. The research is conducted for three months from February to April 2018. Parameter measured is reconstruction concept ability and improving studies result. Concept reconstruction measuring three aspects; there are reconstruction occurrence, understanding and not understanding. Improvement in result studies is measured with gain normalization score (n-gain). Instrument used is module based constructive and objective test with Certainty of Response Index (CRI). Answer sheet. Data collection is conducted through pre-test and post-test.

3. DATA AND ANALYSIS

Pre-test and post-test score data is tabulated, estimated the average and gain by finding difference between post-test and pre-test score. The result occurred is then normalized using formula from Meltezer (2002).

$$g = \frac{\text{post-test score} - \text{pretest score}}{\text{maximum possible score} - \text{pretest score}}$$

Concept understanding data is analyzed through percentage estimation toward questions that will be answered correct, wrong, level of conviction chosen and reason accuracy collected. Analysis result is categorized into three; (1) understand, (2) do not understand, (3) misconception. Criteria used is tabulated in

Table-2. Data of improvement studies result is analyzed through difference test between pre-test and n-gain score with t-test.

Table-2: Criteria Certainty of Response Index (CRI).

Answer	Reason	CRI	Category
True	Right	>2.5	Understand
True	Right	<2.5	Understand
True	Not right	>2.5	Misconception
True	Not right	<2.5	do not understand
False	Right	>2.5	Misconception
False	Right	<2.5	do not understand
False	Not right	>2.5	Misconception
False	Not right	<2.5	do not understand

(Hakim et al., 2012)

4. RESEARCH RESULT

4.1 Concept Understanding Analysis

Analysis result of concept understanding (Figure 1) shows that understanding experience improvement while do not understand and conception decrease. Understanding criteria increase from 14.36% to 68.92% (increase of 54.56%). Do not understanding criteria decrease from 70.19% to 25.75% (decrease of 44.44%) while misconception decrease from 15.46% to 5.13% (decrease of 10.33%).

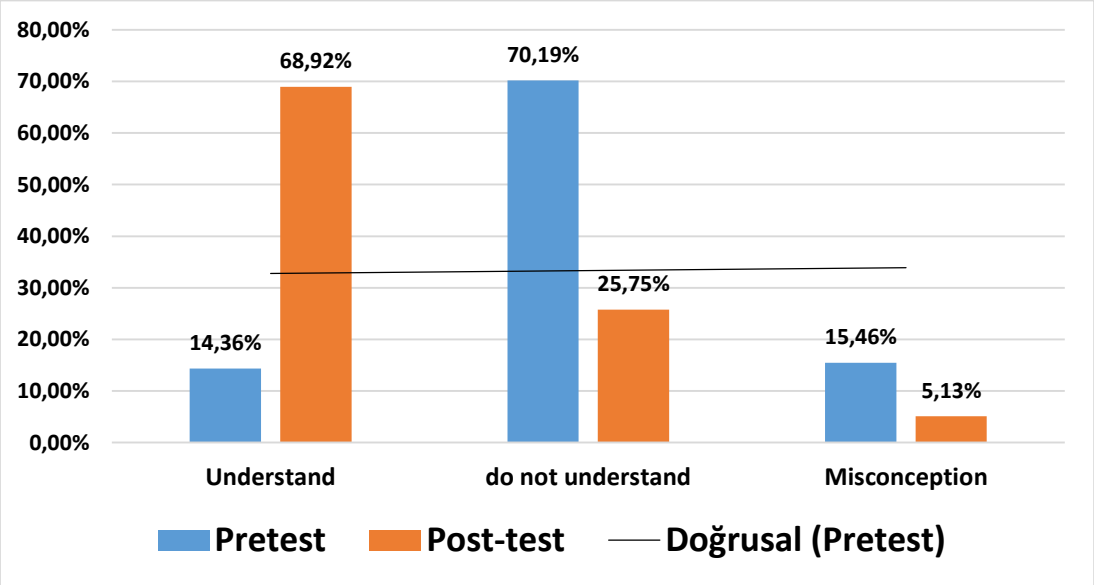

Figure 1. The percentage level of understand, do not understand and misconceptions

Concept based understanding level (Figure 2) shows that student initial knowledge (pre-test) regarding all plan cell concept is very low (average of 23.24%) compared with post-test knowledge that achieve an average of 93.6%. The lowest initial understanding is cell transportation concept (9.05%) and the highest is cell chemistry concept (33.12%). Post-test measurement resulted in concept understanding increase in all concept aspects (concept, transportation, organelle, structure and cell chemistry). Average understanding improvement reached 70.37%. Highest understanding improvement is cell organelle concept (57.98%) and the lowest is cell chemistry concept (42.10%).

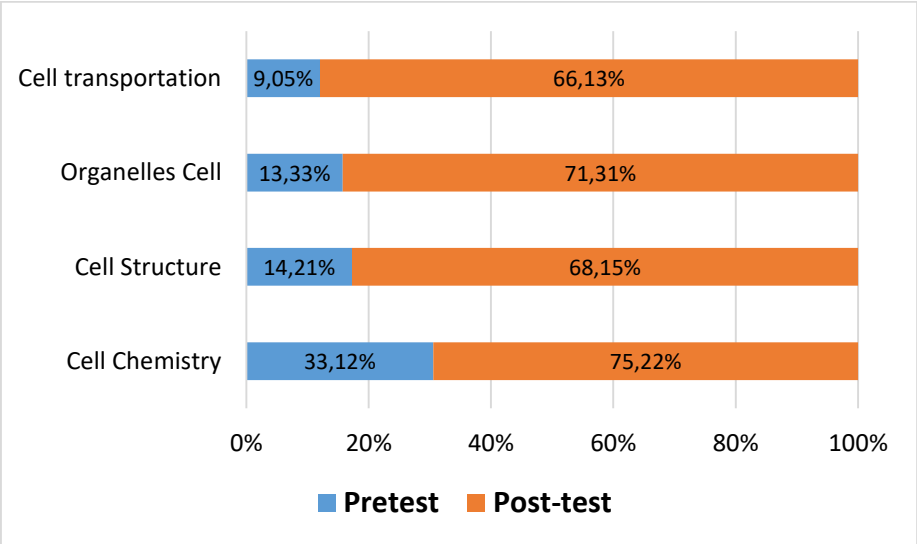

Figure 2. Percentage of understand category based on cell concepts

Students initial knowledge (pre-test) regarding concepts that are not understood is high (Figure 3), average of 66.55% compared to final student knowledge (post-test) with average of 24.80%. The highest not well understood concepts for student is cell transportation (50.08%) and the lowest concept is cell structure (34.92%). The result of final measurement (post-test) show that not understood concepts is decrease at all concepts (transportation, organelle, structure and cell chemistry) with average of 41.75%.

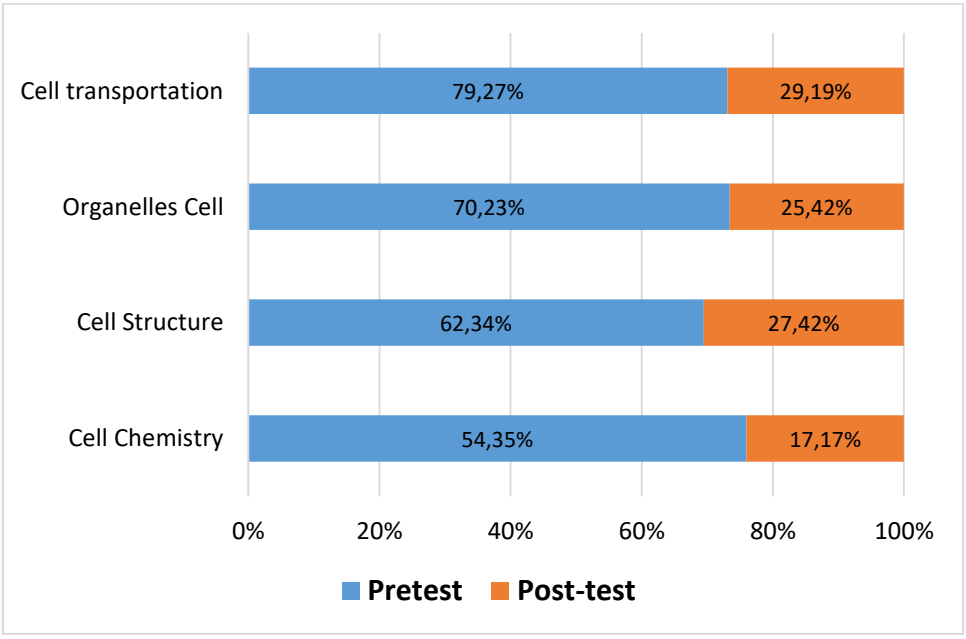

Figure 3. Percentage of do not understand category based on cell concepts

Students' initial knowledge regarding misconception is also very high (Figure 4) with average achieved 16.68% compared to final knowledge (post-test) with average of (5.75%). The highest misconception is cell structure concept (18.91%) and the lowest is chemistry cell concept (5.01%). Measurement result of post-test show misconception decrease at all concepts (transportation, organelle, structure and cell chemistry) average decrease of 10.93%

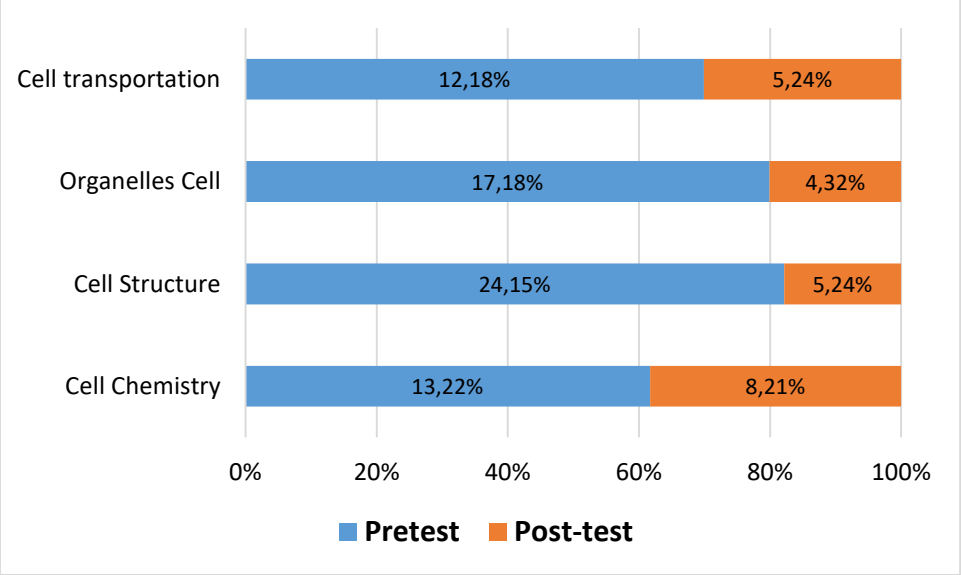

Figure 4. Percentage of misconception category based on cell concepts

4.2 Concept Comprehension Ability

Measurement result and ability analysis in concept understanding (Figure 5) shows that student initial knowledge in understanding cell concept is really low with average pre-test score of 43.46. Ability of understanding cell concepts after learning is higher compared to initial knowledge. Increase (n-gain) in understanding concept ability with the average of 68.77.

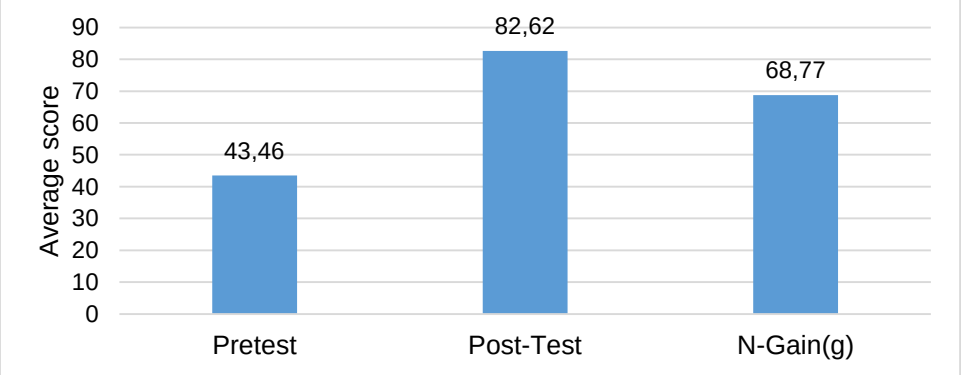

Figure 5. Concept comprehension ability

The result of two average pre-test and post test score show there is a significant difference (Table-2). Thus, it is believed that learning process through module based constructivism is truly effective in increasing student concept understanding ability. Besides understanding ability, this learning process also effective in decrease the misconception.

Table 2. The results of the average difference test between pretest score and n-gain score

Average Score		Normality*		Homogeneity**	Significant
Pretest	n-gain	Pretest	n-gain		
43,46	82,77	Normal X^2_{count} (13,93) < X^2_{table} (52,93)	Normal X^2_{count} (32,66) < X^2_{table} (124,1)	homogeneous F_{count} (1,94) < F_{table} (3,96)	significantly different $t\text{-}_{count}$(21,2) > $t\text{-}_{table}$ (1,65)

* Chi Square Test (Normal: $X^2_{count} < X^2_{table}$ (α=0,05)

** F-test (Homogeneous: $F_{cout} < F_{table}$ (α=0,05)

Incremental in concept understanding ability, reduce in misconception shows that reconstructions concept occurrence within students. It is defined as changes in understanding concepts occurred during learning process. Changes in concept understanding occurred from alternative conception and misconceptions into correct understanding concept (Chi & Roscoe, 2002). Learning process through module based

constructivism can be implemented to increase student ability in concept reconstruction. Even though in learning process through module based constructivism is unable to fully improve concept understanding. There is other factor that lead to misconception. Learning process though module automatically forced student to read more and understanding the content of the module. Student who are lazy to read will be hard to absorb concept being learnt only by using modules. This act indirectly become the weakness in the effort of increasing concept reconstruction. The results of the Al-Weher study (2010) recommend that the introduction of constructivist ideas in educational programs through the learning process needs to be developed. The pursuit strategy designed through modules is very effective to improve the ability to produce concepts that have been learned. Wasmann-Frahm (2010) also reports that the development of classification skills can help students build their own concepts and reduce misunderstandings in understanding concepts.

5. CONCLUSION

The research result shows that understanding concept ability increase to 54.56%, not understanding decrease to 44.44% and misconception decrease to 10.33%. Result of t-test shows that there is significant differences between pre-test score (initial ability) and n-gain score (last ability) at significant scale of 95% (α=0,05). The research conclusion is that learning through constructivism module based is effective toward student in improving reconstruction concept ability and studies effectivity.

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