

Guided Discovery Learning Based on Internet and Self Concept: Enhancing Student's Critical Thinking in Biology

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Abstract

In 21st century critical thinking is needed on deciding what to believe or do. It can be learnt and developed in learning process which giving the students opportunity to be active in exploring the answer of the question and learning context sustainably. The research method is quasi experiment with factorial design by level 2x2. Both experiment and control class applied Guided Discovery Learning adjust with 2013 curriculum. The difference experiment classes conducted it based on internet, control class based on textbook. The research subjects were the students of class VII South Tambun Six State Junior High School, experiment and control classes each consisted of 118 students. The students were grouped into positive and negative self-concept based on scores obtained by using instrument of PHCSCS version. The research was carried out for 4 months, in life organizational system material. Student's critical thinking was measured by essay, were conducted into three times posttest. The research's results by two way ANOVA for learning process was obtained $\alpha=0.000$, self-concept $\alpha=0.025$, and for interaction of learning process and self-concept $\alpha=0.545$. The research's conclusion there was influenced learning process and self-concept for enhancing student's critical thinking but no interaction of influence.

1. INTRODUCTION

The 21st century is a transitional century with many rapid and massive changes taking place, including changes in the global economy, relations between politics, information, communication, science and technology, which have implications for the teaching profession (Milliken, 2004). According to Kellner (2000), the technological revolution had a major impact on people's cultural life. Since information has become more important than industry, this has encouraged citizens to have intellectual capabilities in the 21st century. According to Kharbach (2012) the most needed intellectual ability in the 21st century is the ability to think critically. It's supported by Zivkovic (2016) research that concluded critical thinking is important attribute for success in the 21st Century.

Critical thinking is rational and reflective thinking that is centered on deciding what is believed or done (Ennis, 2011) which is translated

into five indicators namely: 1) base clarification, 2) the basis of a decision (the bases for a decision), 3) deciding (inherence), 4) advance clarification, 5) presumption or estimation and integration (supposition and integration). Critical thinking skills can be learned, so these skills can be taught (Robbins, 2005). The same thing was stated by Eklof (2005) that critical thinking skills are a habit and guided intellectual skills for reliable understanding; this habit is not taken from birth but must be learned. Based on this, an educator should be able to help students to have and develop critical thinking skills in the learning process carried out. Critical thinking skills need to be developed sustainably in the learning process (Kealey et al., 2009).

Based on observations in particular science learning, students' critical thinking abilities in South Tambun Six State Junior High School are still low, this can be shown that just 3 - 5 students from 38

students per class who have the ability to ask questions and express opinions or argue, which it is one of critical thinking ability indicator. The factors that cause students' critical thinking skills are less empowered by the teacher because they do not have good competence in designing learning (Aybek, 2007).

Some studies related to this include Lestari et al. (2014), Ariani et al. (2014), Surayya et al. (2014), Daud and Hapsari (2015), Suminar (2016), Fuad (2017) who found that learning strategies can influence critical thinking skills, the application of learning models were matched with the characteristics of the subject matter. Guided discovery learning is one of learning's model that currently applied in Indonesia, which was adopted in the 2013 curriculum (Nurdiansyah, 2016).

Guided discovery learning is discovery learning models that is guided by the teacher in its implementation. As Bruner's opinion, this learning model can be defined as learning that occurs when students are not given material in the final form, but rather are asked to arrange the material itself (Emetembun, 1986). This opinion states that students must play an active role in learning in the classroom that is asking students to independently explore answers in the context of learning (Sahin, 2009). However, discovery instructions are limited to "time" and "wrong" problems (Chich, 2016). A teacher must be able to guide students to make correct thinking and control over the overall learning context to reduce errors. The syntaxes of guided discovery learning consist of 1) Stimulation, 2) Problem statement, 3) Data collection, 4) Data Processing, 5) Verification, and 6) Generalization (Syah, 2010).

One of effort to support learning activities with the guided discovery learning model in the 21st century which is the digital era can be done by involving students in exploring knowledge and insights from various sources using technology that is familiar with their lives. According to Prensky (2001) computers, games, e-mail, internet, cellular phones, and short messages are part of the lives of students. Various information in the field of education and other fields can be accessed easily through the internet through web search engines (Nentwich, 2003). In addition, the use of the internet also allows students to think critically and creatively, to become collaborative and cooperative workers and to solve problems (Dryli & Kinnaman, 1996). Based on this, the use of the internet can improve the quality of education and bring many positive changes to teachers and instructors (Charp, 2000).

There are internal factors of students need attention in learning implementation. According to Peng et al. (2011) in the process of implementing learning which is the main obstacle is a psychological obstacle that is lazy to think and look

at the impossibility of discovery, and the second is to think that discovery is only a cursory thing. Students with less positive academic self-concepts tend to lack learning motivation, which can lead to poor academic performance (Liu, 2009). The same thing were expressed by Williams and Williams (2010) and Schutte (20017) students with negative perceptions of their academic abilities, avoiding academic assignments because they view it as a personal threat, have low aspirations and weak commitment to goals related to tasks and think about personal shortcomings and poor outcomes . So, the psychological barrier in guided discovery learning is the self-concept of students.

Self-concept is an understanding of self or an idea of self (Desmita, 2010) that reflects an image, an assessment of self. According to Agustiani (2009) self-concept is not a congenital factor, but develops from a continuous and differentiated experience. Zimmerman, and Martinez-Pans cited by Williams and Williams (2010) explain that when beliefs are formed, they influence a student's performance on choice of activity, amount of effort, level of perseverance, and types of meta-cognition learning strategies. According to Veiga & Leite (2016) self-concept can be analyzed by observing 6 factors, namely: 1) Anxiety, 2) Physical appearance, 3) Behavior, 4) Popularity, 5) Happiness, and 5) Intellectual status.

In this case, implementation guided discovery learning base on internet and students self-concept are expected will give influence to enhance students' critical thinking skill. The purpose of this study was to determine the influence of guided discovery learning based on internet and self-concept on critical thinking skills in biology learning, especially the organizational system of life in South Tambun Six Junior High School to solve the problems related to low critical thinking skills. This research is focused on subject matter about the organizational system of life because based on preliminary tests on 7th grade students as many as approximately 417 students, it is quite difficult compared to others in second semester with details 13.4% stated difficult, 73.71 % is quite difficult and only 12.89% is easy. In addition, the material system of life organization also requires a more detailed source of information because exploration with practicum has limited ability to provide a full picture of this subject matter, especially about cells.

2. RESEARCH METHODS

This research was conducted with a quasi-experimental method to determine the influence of guided discovery learning based on internet and self-concept on critical thinking skills in biology learning, especially subject matter about the organizational system of life. The research design used was factorial by level 2 x 2. It can be shown in Table 1.

Table 1. Matrix of Research Design

| Self-Concept (B) | Guided Discovery Learning (A) | |
|----------------------------|---------------------------------------|---------------------------------------|
| | Base on Internet (A ₁) | Base on Textbook (A ₂) |
| Positive (B ₁) | A ₁ B ₁ | A ₂ B ₁ |
| Negative (B ₂) | A ₁ B ₂ | A ₂ B ₂ |

Note :

A₁B₁ : *guided discovery learning based on internet with positive self-concept*

A₁B₂ : *guided discovery learning based on internet with negative self-concept*

A₂B₁ : *guided discovery learning based on text book with positive self-concept*

A₂B₂ : *guided discovery learning based on text book with negative self-concept*

The target populations in this study were VII grade students in South Tambun Six State Junior High School in the 2017/2018 Academic Year, Kabupaten Bekasi. The VII grade students in South Tambun Six Junior High School consisted of 11 classes. Sampling is done by multistage random sampling method.

First, the South Tambun Six Junior High School was chosen as the research site with a purposive sampling method. Second, assign VII grade students as a research class with a purposive sampling method. Third, selecting 5 experimental classes and 5 control classes from 11 existing classes with simple random sampling technique with experimental class carried out internet-based guided discovery learning model, while the control class carried out textbook-based guided discovery learning model, each consisting of 179 students and finally determined the number of samples for the experimental class and the control class by sorting the results of the instrument self-concept by using the Cureton formula (1957) multiplying 33% of the students in the experimental class and control class, the amount of sample each consisted 118 students to be grouped 59 students into upper and 59 students lower group.

The self-concept measurement was carried out using a questionnaire developed from Adolescents' Self-concept Short Scale: A version of PHSCS Feliciano Veiga, António Leite in 2016 which consists of 5 choices of responses namely Very Appropriate, Appropriate, Doubtful, Unaccordance and Strongly Unaccordance. Score scale for positive statements consisted of 5 = Very Appropriate, 4 = Appropriate, 3 = Doubtful, 2 = Unaccordance and 1 = Strongly Unaccordance. . Score scale for negative statements consisted of 1 = Very Appropriate, 2 = Appropriate, 3 = Doubtful, 4 = Unaccordance and 5 = Strongly Unaccordance. Measurement of critical thinking skills using written tests in essay form. Written tests are prepared based on core competencies, basic competencies,

objectives and indicators of critical thinking skills. Score scale of the answer 0 until 3.

Before the instruments were used, expert review was carried out by experts as validators to determine the validity of the item of instruments. Readability and accuracy of the concept of item questions were done by validators in the field of psychology and in the in the field of biological science. Then, accuracy and precision of the instruments of critical thinking skills and self-concept for measuring functions by conducting a validity test. The validity test of the instrument of critical thinking skills and self-concept were done by using Pearson product moment to obtain valid items or statements used when collecting data. Calculation of the reliability coefficient to determine the consistency level of the instrument in several times using Cronbach Alpha.

3. RESULTS AND DISCUSSION

The instrument of self-concept and critical thinking were validated by validators before using in data retrieval. The validation result of self-concept instrument got 3.89 (0.00-4.00), it's very valid category. The validation result of critical thinking instrument got 3.56 (0.00-4.00), it's very valid category too.

The validity and reliability of self-concept instrument was tested by 157 students of VII grade students in South Tambun Two Junior High School. The validity result of self-concept was tested by using Pearson Product Moment formula, there were 28 from 30 statements can be used to measure student's self-concept. The reliability of self-concept was tested by using Alpha Cronbach formula, it got 0.833 > 0.500, it meant that it was reliable instrument. The validity and reliability of critical thinking instrument was tested by 66 students of VIII grade students in South Tambun Two Junior High School. The validity and reliability of critical thinking instrument was tested by using Pearson Product Moment formula, there were 23 (8 questions about cell, 7 questions about tissues, 8 questions about organ and organ systems) from 24 questions can be used to measure student's critical thinking. The reliability of critical thinking was tested by using Alpha Cronbach formula, the reliability was done into three parts suitable with sub material (cell, tissue and organ), they got 0.858, 0.710, 0.833. All of them > 0.500, it meant that they were reliable instruments.

After validity and reliability test were carried out, the self-concept data was collected by using self-concept instrument. The critical thinking data was collected from posttest after the students have been taught by the teacher used guided discovery learning model base on textbook for control class and used guided discovery learning model base on internet for experiment class. They learnt cell, tissue and organ.

They learnt cell, tissue and organ in different session. So, there were three times of posttest. Posttest about cell, tissue and organ. The experiment and control classes each consisted of 118 students. The critical thinking of students were analyzed by grouping 59 students into upper group who had positive self-concept and 59 students lower group who had negative self-concept based on scores obtained by using instrument of PHCSCS version.

After measuring student's critical thinking, the first stage was prerequisite test for data analysis.

The prerequisite test of this research analysis includes normality test using Kolmogorov Smirnov test with $\alpha = 0.05$ and homogeneity test using Levene test using SPSS Version 20 application on the results of critical thinking skills test of students who have obtained guided and internet based textbook learning model learning both students who have a positive (high) self-concept and a negative (low) self-concept. The data result of normality test using Kolmogorov Smirnov was shown in Table 2.

Table 2. The Result of Normality Test

| | Model Guided Discovery Learning base on Internet | | Model Guided Discovery Learning base on Textbook | | |
|-----------------------------------|--|--|--|--|-------------|
| | <i>Self Concept Positif (A₁B₁)</i> | <i>Self Concept Negatif (A₁B₂)</i> | <i>Self Concept Positif (A₂B₁)</i> | <i>Self Concept Negatif (A₂B₂)</i> | |
| N | 59 | 59 | 59 | 59 | |
| Normal Parameters ^{a,b} | Mean | 0E-7 | 0E-7 | 0E-7 | |
| | Std. Deviation | 15.13377081 | 18.02796778 | 14.38961080 | 15.22377198 |
| Most Extreme Differences Absolute | | .068 | .080 | .063 | .069 |
| | Positive | .045 | .073 | .055 | .065 |
| | Negative | -.068 | -.080 | -.063 | -.069 |
| Kolmogorov-Smirnov Z | .522 | .614 | .484 | .533 | |
| Asymp. Sig. (2-tailed) | .948 | .845 | .973 | .939 | |

Based on the Table 2, each group gets the results of significance $p > \alpha$ ($\alpha = 0.05$) which means that H_0 is accepted, it can be concluded that all data were normally distributed. The data result of homogeneity can be shown in Table 3

Table 3. The result of homogeneity test

| F | df1 | df2 | Sig. |
|-------|-----|-----|-------------|
| 1.745 | 3 | 232 | .159 |

Based on the Table 3, $F_{count} = 1.745 < F_{table} = 2,645$, it means that H_0 is accepted, it can be conclude there is no difference in variance between groups or between treatment. The result of degree of freedom in Table 3: first degree of freedom or $df1 = 3$ is obtained 4 groups of data in homogeneity test is reduced by 1 or $4-3=1$. The four groups of data consist of 59 students who had positive self-concept, 59 students who had negative self-concept. Both of them learned with guided discovery learning base on internet. 59 students who had positive self-concept, 59 students who had negative self-concept. Both of them learned with guided discovery learning base on textbook. Second degree of freedom or $df2=232$ is obtained by reducing 236 (59 students from each groups multiplied 4) with 4 groups of data or $236-$

$4=232$. The homogeneity test obtained the results of significance $p = 0.159$. The results of significance $p > \alpha$ ($0.159 > 0.05$) which means that H_0 is accepted, it can be concluded that all groups of data came from populations with homogeneous variances. When all data were normally distributed and came from populations with homogeneous variances, hypothesis of experiment by two way ANOVA can be done. Calculation of data on students' critical thinking skills with ANOVA was obtained in Table 4 :

Table 4. The result of two way ANOVA

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|-------------------------------|-------------------------|-----|-------------|----------|-------------|
| Corrected Model | 10605.847 ^a | 3 | 3535.282 | 14.002 | .000 |
| Intercept | 602263.068 | 1 | 602263.068 | 2385.400 | .000 |
| Pembelajaran | 9231.254 | 1 | 9231.254 | 36.562 | .000 |
| Selfconcept | 1281.780 | 1 | 1281.780 | 5.077 | .025 |
| Pembelajaran * Selfconcept | 92.814 | 1 | 92.814 | .368 | .545 |
| Error | 58575.085 | 232 | 252.479 | | |
| Total | 671444.000 | 236 | | | |
| Corrected Total | 69180.932 | 235 | | | |

a. R Squared = .153 (Adjusted R Squared = .142)

Based on the table of results of the two-way ANOVA test on the data of critical thinking skills, it was obtained, namely: 1) The results of two-way ANOVA calculations between groups of students given learning with Guided Discovery Learning models based on Textbook and base on Internet were obtained $p = 0.025$, then $p < 0.05$ means that there were the influence of Guided Discovery Learning models based on Textbook and base on Internet for students critical thinking skills, 2) The results of two-way ANOVA calculation of critical thinking skills among groups of students who have a positive (high) self-concept with negative self-concept (low) obtained $p = 0.025$, then $p < 0.05$ means that there is a self-concept influence on students' critical thinking skills, 3) The results of the two-way ANOVA calculation between learning and self-concept obtained $p = 0.545$, then $p > 0.05$ means that there was no interaction between Guided Discovery Learning models based on Textbook or base on Internet with self-concept for the students critical thinking skills.

a. Influence of Guided Discovery Learning models based on textbook and Guided Discovery Learning models based on internet on students' critical thinking skills in organizational systems of life

The hypothesis of the influence of Internet-based Guided Discovery Learning models and Textbook-based Guided Discovery Learning models on critical thinking skills can be proven by calculating data using ANOVA. This is in accordance with the research conducted by Lestari et al. (2014), Ariani et al. (2014), Surayya et al. (2014), Daud and Hapsari (2015) who found that learning strategies can influence critical thinking skills, one of it was the application of learning models that match the characteristics of the subject matter. The effect of the application of the learning

model on critical thinking skills is reinforced by the average value of critical thinking skills . The average value of critical thinking skills from the application of the two models on students who learn with an Internet-based Guided Discovery Learning model obtain an average value of critical thinking skills of 56,771 and students who learn with Textbook-based Guided Discovery Learning models score an average of critical thinking skills of 44,263. This shows that H_0 is rejected and H_1 is accepted.

The application of the two models can improve students' critical thinking skills. However, the Guided Discovery Learning model based on internet in this study resulted in a higher average value of critical thinking skills compared to Guided Discovery Learning models based on textbook. The results of this study was in line with the opinion of Dryli & Kinnaman (1996) that the use of the internet allows students to think critically and creatively, to become collaborative and cooperative workers and to solve problems. This can happen because by using the internet students can easily obtain information and knowledge according to their needs to improve their learning outcomes (Oprea, 2014). In accordance with Nentwich (2003) which states that various information in the field of education and other fields can be accessed easily through the internet through web search engines. It's supported by Park (2009) research.

b. The influence of groups of students who have a positive (high) self-concept with a negative (low) self-concept on critical thinking skills in the material systems of organizational life.

The hypothesis about the influence of groups of students who have a positive (high) self-concept with a negative (low) self-concept on critical thinking skills in the material systems of life organization can be proven by calculating data using ANOVA. Self-concept is an understanding of oneself or an idea of oneself (Desmita, 2010) that reflects an image, an assessment of oneself, in this study it was measured using a self-concept instrument version of PHCSCS. The effect of self-

concept is strengthened by the value of the average critical thinking skills of students who have a positive (high) self-concept higher than students who have a negative (low) self-concept, groups of students who have a positive self-concept (high) got an average value of critical thinking skills 52,847 and groups of students who have a negative self-concept (low) got an average value of critical thinking skills 48,186.

This result was consistent with Liu's (2009) opinion that students with less positive academic self-concepts tend to lack learning motivation, which can lead to poor academic performance. Student's self-concept is an internal factor of students who can determine their success in learning. Peng et al. (2011) that in the process of implementing learning which is the main obstacle is a psychological obstacle that is lazy to think and see the impossibility of discovery and the second is to think that discovery is only a cursory thing. That obstacle can cause the average value of critical thinking skills of students with negative self-concept are lower than students who have a positive self-concept.

c. Interaction Effect of Guided Discovery Learning models based on internet or textbook with positive (high) self-concepts with negative (low) self-concepts on students' critical thinking skills in the material systems of organizational life.

The hypothesis in this study, there is no interaction between the influence of Internet-based Guided Discovery Learning models based on internet or textbook with positive (high) self-concepts with negative (low) self-concepts on students' critical thinking skills in organizational system material. This can occur because if seen from the average value achieved by the group of students with an Internet-based Guided Discovery Learning model with a positive (high) self-concept (A_1B_1) compared to Internet-based Guided Discovery Learning with a positive (high) self-concept (A_1B_2) their achievements were not much different. This can reveal that Guided Discovery Learning based on internet can be effectively applied to students with diverse self-concept as opinion of Prensky (2001) that computers, games, e-mail, internet, cellular phones, and short messages are part of the lives of students.

There was no interaction of the influence of the variable learning model with self-concept. It was more evident that the average value achieved by groups of students with Guided Discovery Learning models based on internet with negative (low) self-concept (A_1B_2) higher than the average value of students. With Guided Discovery Learning models based on textbook with a positive (high) self-concept (A_2B_1). Through these data it can be revealed that students who have a negative (low)

self-concept will not always get a low score as well as students with a positive self-concept (high) will not always get high scores.

This can happen because according to Agustiani (2009) self-concept is not a congenital factor, but develops from a continuous and differentiated experience, then along with the learning process that is done is felt to provide experiences that provide satisfaction for students so that initially negative self-concept (low) changes in a positive direction. As expressed by Fitts (1971) individuals who have high self-satisfaction, self-awareness is more realistic, so it is more possible for individuals to forget their circumstances and focus their energy and attention outside themselves, and ultimately can function more constructively. Once this trust is formed, it affects the performance of a student through its influence on choice of activity, number of attempts applied, level of perseverance, and types of meta-cognition learning strategies called (William & William, 2010). The opposite happens to students who have a positive (high) self-concept.

4. CONCLUSIONS AND RECOMMENDATIONS

Based on the results of discussion and data analysis, it can be concluded, namely: there is the influence of applying guided discovery learning model based on internet to students' critical thinking skills in learning material biology in the organizational system of life in junior high school. There is the effect of self-concept on students' critical thinking skills in learning material biology, organizational systems of life in junior high school. There is no interaction effect between the applications of internet-based guided discovery learning models based on self-concept towards students' critical thinking skills in learning material biology in organizational systems of life in junior high school.

Based on the conclusions in this study, further research is needed that can determine the effect of the learning model before and after the learning is done on the students' self-concept considering that the student's self-concept is not a congenital factor.

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