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The Influence of the Concept Map of Wimba Learning Model in Plant Anatomy for Increase The Result Learning of Biology Students Teachers

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The purpose of this research was to determine the influence of concept map of wimba learning model (based visuospatial) of plant anatomy class with discusses plant tissue material. This research also focuses on increasing student result learning. This research method was quasi experiment. The population on this study was three classes of Biology Education Department, Siliwangi University who took courses plant anatomy on 2015. The samples were taken by purposive many as two classes. Lecture model of Wimba (based visuospatial) were divided into lectures in the classroom and laboratory. 3D media used in this research were play-doh and 3Ds Max. Concept maps were assigned made before the lecture and they presented and discussed at the beginning of the lecture. Practical work was conducted in three dimension microscopic representation. Achievement test was carried out before and after the learning process. The results showed that concept maps assigned to students before the learning has been able to help students improve the result of learning for play-doh media, but not for 3Ds Max. Results of student learning using play-doh in 3D representation tends to be better than the 3Ds Max.

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INTRODUCTION

The concepts of plants structure in plant anatomy is difficult to understand by student, because the form between one cell with other cell is almost the same but actually different. As a biology teachers candidate, students should be able to understand that concept. But in fact the students have trouble to distinguish the plant cell.

Concept maps are effectively used to distinguish and connect one concept to another. Students must be able to choose key concept from book then they mapped it. So that the concept maps created by students can be used as prior knowledge before the lectures. Concept maps can be used as an assessment instrument for pre and post learning activities, to assist in the consolidation, clarification and strengthening knowledge. Map concept generally use a hierarchical structure and relational phrases to help understanding of relationship.

Study of plant structure in college generally conducted in laboratory through two-dimensional observation, then it drawn. Through two-dimensional image is still incomplete, students is still not be able to distinguish between one cell with other cells, they can not fully describe the form and function of cell. Expected through 3D imagination, students are able to understand the plant structure. Thus the microscopic 3D representation becomes more important.
Wimba model is a 3D learning model or called visuospatial model. This model represents a 2D object into 3D object observation. In this study used a microscopic representation of plant tissue structure. 3D learning model (visuospatial) also called Wimba model have proved able to increase learning outcomes and level of logical thinking in plant tissue structure material\(^{12}\).

3D media used in school and college generally is play-doh (PD). PD is a simple conventional 3D media that does not require special skill to use. 3D electronical media has actually been available, such as Autocad, 3Ds Max, and others, have been used in various field of science and technology, but it has not been used in biology learning process.

With advances in software technology of 3D that rapidly developed. 3Ds Max software is able to form a 3D object more flexible and can be rotated, so it can be seen from the top, bottom and front more real. The use of 3Ds Max is expected to enhance student’s imagination to represent 2D objects into 3D objects. So it can increase the representation of microscopic skill, imagination, and conceptualization.

The purpose of this study is to know the influence of using map concept in students teachers learning outcomes in plant tissue material by using a 3D media play-doh (PD) and 3Ds Max.

### RESEARCH METHODOLOGY

This research method is quasy experiment. The population in this study is the fourth semester students who take the plant anatomy course in 2015 in Biology Department Siliwangi University as many as 3 classes. Samples selected with purposive sampling many as two classes.

Wimba learning model (based visuospatial) divided into two activities, that are classroom lectures and laboratory experiment. 3D media uses in this study are play-doh (PD) and 3Ds Max. Because of the limitation of computer that meet the specification of 3Ds Max, then this study carried out in groups. Students were divided into 5 groups. Each group consist of 5 students.

![Learning processes diagram](image)

**Figure 1. Learning processes**
Concept maps were assigned made before the lecture and they presented and discussed at the beginning of the lecture. Course materials covered are:
1. Ground Tissue
2. Vascular Tissue
3. Dermal tissue

After discussion of the concept map, then followed the presentation of material by selected group, then discussion and ends with a confirmation. Assessment of concept maps based on scoring criteria of concept maps as follows:
1. Proposition : two or more concept which connected by verbs and form a meaningful sense, if valid score = 1
2. Hierarchy : at first, general concept forming a branch toward a more specific concept, each sub ordinate shows the more specific concept. Scores for each level = 5
3. Crosslink : if map shows the cross-connection between one segment with other segment, score = 10
4. Example : giving a valid example, score = 1

Practical work held after the lectures. The steps in this practical work are microscopic observation, observation of preparation. The result of their observation, shown in a 2D image, and then creating 3D form through drawing and continued making 3D with play-doh and 3Ds Max. Learning outcomes data obtained through pretest and postest plant tissue materials. N-gain calculation based. Data processing was performed using SPSS 21.

RESULTS AND DISCUSSION

Lectures of plant tissue structure with Wimba models, first starts with making a concept map. Concept maps were made based on plant anatomy course reference book. Students have been trained to make a concept map in three times in previous meeting. The result of concept maps created by students are presented and responded by their friend in class and discussed. Thus students are expected to understand the concepts that will be learned. Lectures conducted by presentation by a group that has been assigned to do the presentation, and then conducted a discussion and confirmation. Furthermore 3D practical work conducted.

![Figure 2. Average of concept maps assessment that using play-doh and 3Ds Max media.](image)

Result of concept maps created by students showed that concept map in PD group are better than concept map in 3Ds max group (figure 2). It seems that the PD group more serious when do the task of concept maps. 3Ds Max group seems create a map concept more simple and using common words that are less precise. T-test result showed that there is a difference between the result of PD concept maps and 3Ds Max (Tab. 1)
Cognitive result learning in plant tissue material shows that there is slightly difference learning outcomes between using PD and 3Ds Max. Posttest result showed that the Wimba learning model assisted with concept maps in PD group tend to be better than 3Ds Max group (Figure 3.). PD group seemed to be more focused on the 3D task, because the number of PD media is available in a rather large stock so that every student can actively participate in designing and creating 3D plant tissues. Students can represent their observation of 2D (visual) and then creation of their 3D imagination (visuospatial) into 3D plant tissue product. There are still many students who are less precise in making 3D tissue model. The increasing of learning outcomes (N-gain) students were counted and classified by Meltzer (2002) still in low category.

In 3Ds Max group to create 3D using 3Ds Max software, in which it requires high specification laptop. Not all student’s laptop can be used, so that in group not all member or students actively participate in creation their 3D imaginations. Using 3Ds Max also requires special skills, it need more practice until their skilled to used 3Ds Max software. Because of the limitation of tools not all students can do it well. This affects their learning outcomes, because students are not experience the internal cognitive process individualized.

![Figure 3. Average of cognitive learning that using PD and 3Ds Max](image)

According to ², designing is a cognitive process that consist of several activities such as visuospatial thinking, sketches and models, all three of these activities involve visuospatial representation. In other words, constructing a visuospatial representation refers to visual and spatial modeling from the elements that required to use in which this model constructed internally (mentally) or external (physical).

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<td>There are correlation between concept maps and learning outcomes</td>
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<td>There are significance influence of concept maps towards learning outcomes</td>
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<td>probability = 0.302</td>
<td>There are no correlation between map concept and learning outcomes</td>
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Visuospatial thinking, sketches, and models include highly dynamic internal and external models related to perception, reason and planner activity. Creating 3D plant tissue also through designing 3D products activities.

The result of correlation test in PD group, shows that there is a correlation between a concept map with result learning (table 1). This shows that making concept maps related with increased result learning. After knowing there is a correlation of two variables, then performed a regression analysis, after calculation of simple regression test by using SPSS there is significance influence in creating concept maps with increased in learning outcomes in PD group. So in learning outcomes of PD group is influenced by creating concept maps. Whereas the result of correlation test for 3Ds Max group, showed that there is no correlation between the concept maps with increased result learning in a 3Ds Max group.

**CONCLUSION**

Based on the result of this study about the influence of the concept maps of wimba learning model for increasing learning outcomes of biology students teachers can be concluded as follows.

1. There are difference results of concept maps between PD group and 3Ds Max group.
2. The average of assessment of concept maps in PD group is better than 3Ds Max group.
3. There are differences in cognitive result learning in plant tissue material between PD group and 3Ds Max group. Result learning shows that wimba learning model assisted with concept maps in PD group tends to be better than 3Ds Max group.
4. in PD group there is a significance influence between a concept maps toward increase of students result learning and in 3Ds Max group showed that there is no influence between concept map toward increase student learning outcomes.

**SUGGESTION**

The suggestion in this study are as follows.

1. In creating of 3-dimensional, students must experience internal cognitive processes individually.
2. Student’s Plant anatomy reference books should be based on 3-dimensional.
3. Training using 3Ds Max software needs to be optimized, because it can help students represent 3D.
4. Using 3Ds max requires a computer with high specification, need to upgrade the computer facility, so that all students can be active in 3D learning activities.

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The Usage Of Interactive Multimedia Simulation Model To Increase The Students Analysis Skill In STKIP At Garut (Quasi Experimental Teaching Of Animal Physiology The Biology Education Courses At STKIP Garut)

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**Abstract**
This research is based on the low level of student ability analysis on STKIP in Garut. To overcome this, done research in Animal Physiology practical lectures using interactive multimedia simulation models. This research examines the problem of increased analysis capabilities of students using interactive multimedia with students who use conventional learning methods. This research is a research quasi experiments with making purposive sampling technique using sampelnya. The population of this research is to Study all students who take Biology education courses in Animal Physiology lesson in 2014/2015. The sample of this research is a student of class B and class C. instruments used in this research in the form of tests analysis capabilities. Data analysis was carried out quantitatively. Data analysis Capability analysis done with test Mann Whitney-U to pretes and N-Gain. The research results showed that improved analysis capabilities of students who used simulation models interkatif multimedia better than students who do not use interactive multimedia in the teaching of animal physiology of the digestive system in Paramecium sp STKIP in Garut. Based on the results, it is recommended to use Interactive Multimedia simulation models can be used in practical of Biology education courses to enhance students' analysis capability, especially in organizing aspect. Then, on further research is expected to examine the use of interactive multimedia simulation models to improve the students’ ability in other areas, such as psychomotor or affective.

**INTRODUCTION**
Study on the fact is the way which is done for the learners to discover the identity and nature of actual life. As articulated by Gordon, et al. (2004:2) "the Goal behavior can be categorized into two types-master and performance. A mastery goal is oriented learning such as possible for the purpose of self-improvement, irrespective of the performance of other. A a porfermance foal focuses on social comparison and competition, with the main purpose of outperforming others on the task ". With a good learning process, the learners are expected to gain the learning objectives that useful for themselves and also for their social environment. Learners are expected not only to be able to memorize the entire subjects but also to apply their knowledge in their daily activities and in the end they are able to differentiate the good and bad things in life. Learning objectives will be achieved easier if the learners have several special abilities, such as the ability to process various informations and show the relationships between the various informations with an individual ability to determine the matter parts and show the relationships within that parts, to see the causes of an event or to give arguments to support a statement , it can be called as analysis capability. Analysis
capability is one of the main skills that should be possessed by the learners, because in the learning process especially in practical subject, they are required to explain the results of the practical subject and theory of causal relationships that exist with the results obtained. But in the phenomenon appears, some learners still have a less analysis capability in the learning process. Actually, it can be solved with various ways, one of them by utilizing the existing learning media at school. The learners’ analysis capability will be improve by using an interesting multimedia. Based on the observation in the teaching and learning process of Physiology of animals in STKIP Garut Biology education, it shows that the process is not running well yet, it can be proved by the learners’ analysis capability. In the teaching process, the learners’ analysis capability is weak because there is some difficulty in the practical processes, it can be seen from the practical result and the average of the value which is not appropriate with an expecting learning purpose and completeness.

Based on the learning issues of the learners’ capability in using interactive multimedia as a solution, the researcher conducted a study entitled "The usage of Interactive Multimedia Simulation Model to improve the learners’ analysis capability In Stkip Garut Academic Year 2014/2015". The researcher formulates the problem as follows, "is the usage of interactive multimedia simulation model will enhance the learning interest and the analysis capability of the student at STKIP Garut?". In General, this research aims to produce interactive multimedia simulation model to improve the learners’ analysis capability. The results of this research are expected to be beneficial for the education environment especially in practical courses of Animal Physiology.

**Education and Learning**

Education is an absolute right for every citizen. Education has a very broad scope, including all human thought and experience of education. The act of educating is not gratuitous; it is the action that totally based on the guidance and conscious in order to guide human being to achieve the goal (Sadulloh, 2003:2). The purpose of education is not only refers to the value achieved, the goal of education is the occurrence of behavior changes, a change from does not know something to know something, from unable to be able to do something, from unable to be able to distinguish the good and wrong. Factors that influence in the learning process of learning, such as learners, teachers, facilities and infrastructure, as well as the environment. Learner is the organism to evolve in accordance with the stages of its development (Sanjaya: 2011:17).

**Education Technology**

Education technology is indeed closely related to the usage of media in school because technology has the function to facilitate the human in performing daily activities. According to AECT 1977, education technology is an integrated complex process includes: people, procedures, ideas, facilities and organization to analyze the problem, to design, implement, assess, and to solve the problem in all human learning aspects (Warsita, 2008). Learning technology formulated based on five areas, commonly called as learning technology areas (Darmawan, 2012:4). The areas are design, utilization, management and assessment.

**Interactive Multimedia**

Learning media is anything that can be used to transmit a message from the sender to the receiver so it can be stimulate the thoughts, feelings, concerns, and interests as well as the attention of students so the learning process can be happened (Sadiman, 2007:7). According to Robin, Linda (in Darmawan, 2012:47) "multimedia is a tool that can create a dynamic and interactive presentations that combine text, graphics, animation, audio and video”. The last interactive multimedia model that used by the researcher in this
research was interactive multimedia simulation model. Basically the application of interactive multimedia model is giving a real imitation or example about the learning process happened. Simulation model is divided into four categories: fictions, situations, procedures, and processes that each of these categories is used in specific goal (Darmawan, 2012:65).

**Analysis Capability**

Analysis capability is cognitive ability which used regularly by the educators to design the learning goal. However, a learner who understand a subject matter not necessarily able to analyze lessons learned. Analyze process category includes cognitive processes that differentiate, organize and distribute (Logman, 2010:120). With the power of a good analysis, then learners will get used in discovering and understanding the concept of learning, so the learners will be easier to apply the material studied from the learning process.

**Lecture Material**

Lecture materials which used in the research is animal physiology lecture. Physiology is the work function includes the function of mechanical, physical, and biochemistry of living beings. Based on the field, physiology is distinguished into two part; plant physiology and animal physiology. Animal physiology discusses about various physiology activities from the living beings especially animal. All the life cycle is characterized by a hierarchical structure of organization level (Neil, 2004:4). On protozoa, digestive process occurring in vacuoles. Firstly, the lysosome ingesting digestive enzyme into vacuoles food. These enzyme causes the atmosphere of vacuoles turned into sour so the food is digested. Furthermore, there was a separation of various calcium salt. This would create the atmosphere of the environment with the proper pH for various enzyme to work optimally. In such circumstances, the food stuffs will be simplified so it can be absorbed by the cytoplasm. The end of the digestion process is characterized by the presence of environment changes in vacuoles become neutral. Undigested food material is ejected through the process of eksositosis.

**RESEARCH METHODOLOGY**

Research methods that used in this study is experiment research method with quantitative approaches. Experiment design uses experimental Quasi. Then to take the sample uses purposive sampling. This research was conducted in STKIP Biology education, Jalan Pahlawan No.32 Tarogong Kidul, Garut. Populations of this research were 90 students of Biology education STKIP Garut who take practical lecture of animal physiology. While the research samples were 60 students who take animal physiology lecture academic year 2014/2015, which has the middle and low capability in practical lecture of animal physiology. Then, the research instrument used was multiple choice tests with 20 items of questions and five choices of answers.

**RESULTS AND DISCUSSION**

An overview of the analysis capability of the students in Biology education STKIP Garut academic year 2014/2015 before the research can be seen in the following table:
Table 1. Analysis Capability the students of Biology education in STKIP Garut in 2014/2015

<table>
<thead>
<tr>
<th>Score</th>
<th>Amount</th>
<th>Percentage</th>
<th>Qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 60</td>
<td>3</td>
<td>5%</td>
<td>High</td>
</tr>
<tr>
<td>59-50</td>
<td>15</td>
<td>25%</td>
<td>Middle</td>
</tr>
<tr>
<td>&lt; 50</td>
<td>41</td>
<td>68%</td>
<td>Low</td>
</tr>
</tbody>
</table>

The table 1 shows that generally the analysis ability of the students of practical lecture of animal physiology is low and the rest is high and middle. Based on the table, 56 students who qualified in low qualification divided into two classes; experiment class and control class. Experiment class uses interactive multimedia simulation model, whereas the control class uses conventional learning model. To find out whether there is a difference analysis capability of the students before and after giving the treatment in experiment class and control class, then the statistical test is done as follows:

Table 2. An overview of the analysis capability of Biology education students in STKIP Garut in 2014/2015

<table>
<thead>
<tr>
<th>Control Class</th>
<th>Experiment Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Average</td>
</tr>
<tr>
<td>Pretes</td>
<td>30</td>
</tr>
<tr>
<td>Postes</td>
<td>30</td>
</tr>
<tr>
<td>N-Gain</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 2 shows that the average score of the students’ analysis capability is still low and under KKM not only in control class but also in experiment class which has score 47,03 for control class and experiment class is 45,07, but after doing the treatment it can be seen that there is a significant improvement between the students’ analysis capability before and after treatment. Students in experiment class obtained higher average score than the control class. The magnitude score of control class from pre-test and post-test is 11,37 while the magnitude score of experiment class from pre-test into post-test is 21,93. Generally, it can be indicated that the students’ analysis capability improvement in experiment class is higher than the control class. Moreover, the average of post-test score in control class is 58,40 still under KKM score which is 60, while the average score of experimental class is 67. This score is higher than the KKM score.

To examine the difference of the usage of interactive multimedia simulation model to the improvement of analysis capability after teaching and learning process between experiment class and control class was used Mann Whitney using SPSS version 20.0, the result can be seen in the below table.

Table 3. N-Gain Normalization Analysis Capability

<table>
<thead>
<tr>
<th>Statistic</th>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann Whitney U</td>
<td>181,500</td>
<td>Ho Rejected</td>
</tr>
<tr>
<td>Z</td>
<td>-3,981</td>
<td></td>
</tr>
<tr>
<td>Asymp.Sig (2-tailed)</td>
<td>0,000</td>
<td></td>
</tr>
</tbody>
</table>

Based on the table 4.3 it can be seen that sig score is 0,000 it shows that sig score smaller than α 0,05 so the Ho is rejected and Ha accepted. It means that there is a
difference of students’ analysis capability between the students who use the interactive multimedia method with the students who use conventional learning method. On the other hand, the analysis capability of the students who use interactive multimedia method is better than the students who use conventional learning method. The students’ average score in pre-test and post-test is increase significantly. The average score in control class increase of 11,37 with an average post-test score 58,40 which is still under the KKM score of Animal Physiology lecture of 60. While the average score in experiment class increase of 21,93 with an average post-test score 67.00 which is higher than KKM score. Then for the average improvement of students’ analysis capability with N-Gain score is 0,21 for control class and 0,39 for experiment class, both classes have a middle average of improvement, but experiment class’ score is higher than control class.

From the result of hypothesis testing N-Gain the score of study interest is sig=0,000, it indicates that the sig score is smaller than $\alpha = 0.05$ so Ho rejected and Ha accepted. It means, there is a difference of analysis capability improvement between the students who use interactive multimedia simulation method with the students who use conventional learning method. Increased analysis capability that occurs in this study was affected by various factors. According to Kemal (2014:1) there are several factors that affect the learners’ cognitive development, one of them is analysis capability such as gen factors, environment factors, maturity, formation, interest, talent and freedom”. Therefore, due to the existing media in the form of interactive multimedia, freedom in exploring self ability by utilizing the previous knowledge with the recent knowledge that accompanied by various interesting learning media display which helps the learners to improve their ability.

By having a concrete learning experience makes the learners easier to differentiate, distribute and organize the various lecture materials given. It can be seen from the improvement, the highest improvement occurred in distribute aspect because in the practical process with uses interactive multimedia methods, the learners are free to explore their ability in understanding and examining and also arguing about the all the things that they found in the practical work, they used to connect various lecture materials that obtained in the practical work with the facts in their daily activities.

CONCLUSION

In practical work of animal physiology, the improvement of analysis capability of the learners who use interactive multimedia simulation model is better than the learners who use conventional learning model. In general the analysis capability of the learners from the Biology education is in the low qualification, especially the existing aspects of organizing which includes the ability to differentiate, diagnose, associate and choose. Furthermore, there is an improvement in analysis capability on the organizing aspect after interactive multimedia simulation model applied, and also there is an improvement on the differentiating and distributing aspect.

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Building Habits of Mind And Ability Thinks Students Via Practicum

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Keywords:
practicum, habits of mind, ability thinks

Abstract
The study about building habits of mind and ability thinks students via practicum had been done. The aim of research to gain an overview of practicum magical power in building the habits of mind and thinking ability to improve the quality of learning. In contrast to the study habits of main another, this study focuses on practical, related to cognitive, affective, psychomotor, as well as the thinking ability. The method used was week experiment with design one group posttest only. The research subject were all students 5th semester, as much as 32, which followed the course of plant physiology lab at the Department of Biology UPI. The results showed that the habits of mind of the average men students in middle category, women in high, and combined in high. Each domain: cognitive, affective, psychomotor of students was high, the highest in the psychomotor. The average student's thinking ability both men, women, and their combined were moderate. The conclusion that practicum can build habits of mind of students in the category of middle to high, and can build student’s thinking ability in middle category. The habits of mind of students that still low, needs to be improved: creating-imagining-and Innovating, persisting, and in the thinking ability include: chemical equations and calculations.

INTRODUCTION

Habits of mind is a thinking intelligent behavior characteristic of a person that can be used to solve problems encountered in daily life. Habits of mind is the basis of behavior that can be formed and can discipline the intellectual processes and building intelligence. Habits of mind have 16 indicators that can be summed [2,3]. The ability to think is a complex intellectual ability of individuals to solve all problems, whether related to comprehension, application, analysis, synthesis, and evaluation, both in the form of completion of test questions as well as the completion of the tasks. The ability to think can be supported by the habits of mind [4,6,8]. The habits of mind and thinking ability should continue to be built on the student. It is thus important investigated how habits of mind and thinking ability are built through practicum.

Has a lot of research related to the habits of mind, of which four studies [2,3,7,9], the research is very important and fundamental details associated with habits of mind and assessment. However, these studies do not focus on practicum, so it does not associate with cognitive, affective, and psychomotor [1], in addition to the ability to think.

The purpose of this study was to obtain an overview of the practical efficacy in building the habits of mind and ability to think on students, while also revealing connection between habits of mind with ability to think. The results could form the basis for the search for alternative learning, practicum in particular, are better able to develop the habits of mind and ability to think, remember practicum seen with regard to the development of habits and thinking ability.
RESEARCH METHODOLOGY

This research was conducted in the Department of Biology Education FPMIPA UPI. Subject of this research were all S1 students 5th semester, as much as 32, including 7 men and 25 women, which followed the course of plant physiology practicum 2014/2015. The research method was week experiment with one group posttest only design [10].

Learning practicum (3 credits) in the form of guided inquiry [8], included the preparation phase (5-6 students flocking preparation procedure, determine the problem, purpose, hypothesis, tools, materials), execution (each group carry out lab), and reporting (presentation of the journal lab results in the classroom, then refined in the form of practical reports). Lecturers acted as mentors and facilitators. After six titles practicum completed (plant nutrients, water culture, diffusion, osmosis, plasmolysis, transpiration) in doing the test.

Instruments used in the form of inventory and testing. Inventory is used to capture the data habits of mind which includes 16 indicators [2,3] and in the form of essay test is used to capture the data the thinking ability. Research data both data habits of thinking and the ability to think, analyzed and grouped on very highi (> 80), high (70-80), middle (59-69), low (39-58), and very low (<39 ). Practical role in building the habits of mind and ability thinks categorized by category habits of mind and ability to think produced.

RESULTS AND DISCUSSION

Habits of Mind of Students

Habits of mind covering 16 indicators [2,3] are grouped in three domains namely cognitive, affective, and psychomotor [1]. As for each aspect and mean values were as follows. Cognitive aspect (high, mean =73.8) include: thinking flexibility (76); metacognition (74); questioning and problem posing (76); aplying past knowledge to new situations (76); creating imagining and Innovating (67). Affective domain (high, mean = 73.4) include: persisting (64); managing impulsivity (70); listening with understanding and empathy (76); striving for accuracy (74); responding with wonderment and awe (76); responsible risk taking (76); finding humor (76); remaining open to continuous learning (75). Psychomotor domain (high, mean = 77.7) include: thinking and communicating with clarity and precesion (75); Data gathering through all sence (76); inter dependently thinking (82). There are differences in the habits of mind of men and women, men (mean = 61.5) is lower than women (77.8). In men there are habits of mind which is very low (3.1%) while the women was not found. The men and women combined was high (74.3). This may imply that women are more familiar, diligent and tenacious in thinking than men. As for the percentage of the value of the combined men and women breakdown were 43.8% very high, 25% high, 15.6% middle, 12.5% low, and 3.1% very low.

It was known from the data that the most prominent aspects was psychomotor. This was in line with the actual conditions, that in the learning lab is dominated by psychomotor activity. Practicum is implementing procedures to test or verify the theory in practice involve psychomotor practice. In the practicum, also requires affective aspects, such as meticulous, careful, honest, tenacious, persevering, do not give up easily. In the lab, can not be separated from the practice habits of cognitive thinking. The low value of persisting of assessment of students, it is in line with that not infrequently the data obtained from the lab does not fit with the theory, it can happen because of a lack of repetition or an error in the determination and data retrieval practicum, or incorrect execution of the procedure.
practicum in which students, in this case, students are less diligent (persist) explore the cause and fix it.

**Ability Think of Students**

The ability think of student related practicum (plant physiology), the test results were vary. The ability think of combined students (men and women) mean: 65 (middle), include the average of men: 64.3 (middle) and women: 65.2 (middle). The details of the percentage of the combined ability thinks are grouped on the ability of very high 9.4%, high 21.9%, middle 40.6%, and low 28.1%. The ability thinking of students can be seen in figure 1.

**Figure 1. Percentage Graph Profile Data Ability Thinks of Students: Men, Women, and the Joint**

The findings on aspects of thinking ability, it turns out conditions mean thinking ability of students in the position of middle, mean = 65 (men 64.3 and women 65.2). Only a few groups who occupy very high (9.4%) and many are in the low group (28.1%). This is partly because students are generally less able to solve problems related to problem solving chart and count, while also involving chemical equations and calculations. As related to aspects of the concept and the procedure is relatively not problematic.

There are three things that underlie the ability to think, namely operation, knowledge, and a tendency [11]. A person is able to use his brain to think of certain operations in accordance with the working mechanism of the brain. It uses cognitive and metacognitive. The ability to think is influenced by knowledge, ie prior knowledge either in the form of concepts, ideas, code, or symbol, called schemata [4.6] which can be synchronized with the concepts, ideas, or new ideas being studied. Tendencies related to environmental influences, work of the heart, and the feelgood factor [6.11].

**Practicum and Customs as well as the ability of Thinking**

Practicum can build habits and thinking ability of students. Practicum includes planning, execution, and reporting, which involves the interaction, both among fellow students, students with laboratory staff, students and faculty, as well as student with the environment, such as books, tools, and materials laboratory. Practicum facilitate students to develop the ability of observation, concept application, analysis, synthesis, and evaluation. Students are required to experience for yourself, seek the truth, to try and test the theory, and draw conclusions on the process that happened [5.8]. Practicum provide students the habit of using tools and materials, investigation, discovery, problem solving, explore and apply the concepts, underlying habits of scientific thought [5.8]. Practicum has the purpose, among others: (1) stimulate interest in learning; (2) teaching laboratory skills; (3) teaching science process; (4) teaching concept, and (5) to teach a scientific attitude [8]. This can have an impact on the habits and thinking skills.

In accordance with the purpose of the lab, habits of mind and thinking ability of students can be built through practical, partly because some things. First, lab develop generic skills, process skills, and experimenting skills. Second, the lab develop critical thinking skills, creative, diligent, honest, cooperative, open, and objective. Third, the lab can make the students are motivated to learn, because it is associated with learning by...
doing. Fourth, facilitate the development of practical scientific investigation. Fifth, practicum students build confidence and facilitate scientific attitude. Sixth, establish practical understanding of the concept by not quickly forgotten. Seventh, lab equip students to become scientists or experts [6, 8].

CONCLUSION

Practicum can build habits of mind of students in the category of medium to high, and can build thinking ability of students in the middle category. The mean habits of mind of men students in the middle category, women in the high category, meaning that women are more diligent than men, while the combination is high. Domains of cognitive, affective, psychomotor is high and the highest in the psychomotor. The mean of ability think of men, women, and their combination was middle category. The Habits of mind and the ability think on men students were the same, in the medium category, but the women students are not comparable, the habits of mind in the high category, the ability thinks in the medium category. The lowest thinking ability that needs to be improved include: creating imagining and Innovating (cognitive) and persisting (affective), and In the thinking ability include: the problems solving involving chemical equations and calculations.

REFERENCES

Development Of Informal Reasoning Regarding Socio-Scientific Issues At The Elementary School, Junior High School, And Senior High School

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Article info

Keywords:
Development of Informal reasoning, Socio-Scientific Issues

Abstract

Informal reasonings (intuitive, emotive, and rational) are the basic reasoning used by most people to solve the problems of socio-scientific issues. Along with a student’s age, informal reasoning should evolve from intuitive towards rational. This study describes how the development of students’ informal reasoning in elementary school, junior high school, and senior high school. Research questions are: 1) Is the development of informal reasoning change at every level of higher education? 2) Is the gender differences produce different patterns of informal reasoning? This research uses descriptive method involved 20 elementary school students, 30 junior high school students, and 30 high school students who attend school on the same foundation, so it is expected to be seen how the role of schools in building students' reasoning ability. Data obtained based on five items test student responses to questions on socio-scientific issues, and through individually interviews based on student responses to written questions. Students response were then grouped into an intuitive, emotive, and rational. The results obtained indicate that informal reasoning elementary, junior, and senior high school has developed in accordance with the increase in levels of education. The increasing level of education, informal reasoning that tends to emerge is rational reasoning. While informal reasoning that tend to appear in female students is rational reasoning, and that tends to appear in male students are intuitive reasoning.

INTRODUCTION

Socio-scientific issues has become something important in science education because it occupies a central role in the process of scientific literacy (Venville & Dawson, 2010). Newton & Osborne (in Sadler, 2004a) reveals that some educational experts suggest to include socio-scientific issues in the learning process in order to produce a society that is responsible and able to apply scientific knowledge, and is also used to think. Means & Voss (in Venville & Dawson, 2010) reveals that the kind of thinking that happens when considering socio-scientific issues called informal reasoning.

Informal reasoning involves the evaluation in response to the complex issues that do not have obvious solutions (Sadler, 2004a). Informal reasoning is considered important when the information is less accessible, or when the problem is more open, debatable, complex, or structured, and especially when these problems requires an individual to construct an argument. Informal reasoning is individualized, meaning that each individual in thinking one thing for sure use the underlying reason for such thinking differently. In contrast to the formal reasoning which usually we know in mathematical logic, then this informal reasoning will be very diverse kinds, depending on how we categorize them.
Democratic societies living in the present era is built on science and technology are presented with socio-scientific issues, and the reasoning process of informal enable them to access, formulate, evaluate, argue, and provide supporting evidence that is strong in the face of socio-scientific issues. Although living in an era like that, on learning at school rarely socio-scientific issues appointed as an ingredient in training students to be able to reason in solving a problem, but in many packaged applications in environmental science community as an issue of controversy.

Development and implementation of learning biology oriented character education can be done through a strategy of Socio-scientific issues, to create contextual learning situations, so it will be intimately linked how to solve these problems by using proper reasoning. The growing age, socio-scientific issues circulating in the community becomes more complex. If on the level of children to adults, informal reasoning an individual does not develop, then an individual would be difficult to answer and take decisions on a wide range of socio-scientific issues, because of socio-scientific issues can be answered using informal reasoning. Therefore, in order to further explore this required preliminary study of the character of students to see patterns of informal reasoning, thus implementing a learning system based Socio-scientific issues will be easier. This research is important to uncover how the development of informal reasoning on socio-scientific issues at the elementary, junior high, and senior high school.

RESEARCH METHODOLOGY

This research uses descriptive method involved 20 primary school students, 30 junior high school students, and 30 high school students who attend school on the same foundation, so it is expected to be seen how the role of schools in building the reasoning ability of students and minimize factors that unwanted appear in the results. Samples were taken by using purposive sampling, ie sampling technique that is done by taking a subject not based on strata, random or region but based on a specific goal (Arikunto, 2012). The objective of this technique is based on the characteristics of students with a good level of achievement, especially in science subjects among other classes.

This study used two instruments, namely open ended questionnaire and interview. Open ended questionnaire was made to categorize patterns of informal reasoning on socio-scientific issues, while interviews are used to explore more in-depth information about the students' answers. Manufacture of instrument refers to the socio-scientific issues related to health issues. Open questionnaire in this study is used to facilitate the categorization of informal reasoning based on informal reasoning categories according to Sadler and Zeidler (2005a) which includes: intuitive, emotive, and rational reasoning.

Interviews are used to dig up answers that are considered difficult to categorize and to explore other informlasi with regard to the reasons and background of the students' answers. Interviews were used in the study is an unstructured interview. Reason uses unstructured interviews because in general the answers are on the results of the open questionnaire that has been answered by the students, and therefore the questions that will be posed to each of the students are not the same, which is related to the students' answers before a relatively diverse in every student.

RESULTS AND DISCUSSION

Development of Informal Reasoning at the elementary, junior and senior high school

Figure 1 shows the pattern of informal reasoning obtained from elementary, junior and senior high school through a written test description about socio-scientific issues and
interviews for more detailed information. Answer students are then categorized and
informal reasoning toga categories as listed in Figure 1. As for the question of socio-
scientific issues addressed to students consists of five items of questions, and the results in
Figure 1 is a categorization derived from students' responses to questions about the whole
socio-scientific issue, so the results in Figure 1 represents the results obtained for the whole
matter.

The development of informal reasoning does not always result in a sequential pattern
of an intuitive, emotive, and rational. In fact the results in Figure 1 show the intuitive
reasoning patterns that tend to appear at the elementary, emotive reasoning tends to appear
on the high school level and rational reasoning likely to arise in junior high school.
Number of reasoning tends more to junior high school students compared to high school
students for high school students are less able to construct knowledge. Especially in the
age of high school, is entering the stage of adolescence labile, where egocentric teenager
appears. In contrast to the pre-operational stage egocentric, self-absorbed teenagers do not
deny that others have beliefs and perceptions of different (Woolfolk, 2009).

Children with higher cognitive development would produce patterns of informal
reasoning is also high, therefore, if it is not facilitated the development of reasoning
informal pun will not develop better. Sedanggkan children who are in a family environment
with a mediocre economy tend to have low reading ability because it has lower access to
books, computers, libraries, and various other educational facilities (Evans, 2004). It is
certainly a major impact on a child's learning and the formation of informal reasoning.

![Graph](image1.png)

**FIGURE 1. Development of Informal Reasoning at the elementary, junior and
senior high school**

![Graph](image2.png)

**FIGURE 2. Pattern of Informal Reasoning based on Gender**

**Pattern of Informal Reasoning Based on Gender**

Figure 2 shows the pattern of informal reasoning that appears on female students and
male students in elementary through senior high school. Answer students from all three
levels of education were then stratified by gender. The results generally indicate that
informal reasoning which dominates the female students is informal rational reasoning. While informal reasoning which dominates the male students is informal intuitive reasoning.

If seen each category, intuitive reasoning tends to dominate the male students, emotive reasoning tends to dominate the female students, and rational reasoning tends to dominate the female students. When summed overall showed that female students tend to be rational and male students tend to be intuitive. As previously disclosed by Gilligan, (1982) that basically women and men do not have subtle differences in decision-making. But, in response to socio-scientific issues that are complex that elicits diverse perspectives of moral, ethical, social, etc., of courses reasoning used by women and men will be different. Particularly those related to moral reasoning. Different of moral reasoning of course affect the resulting pattern of informal reasoning.

When linked to cognitive levels between male students and female students, was higher in female students. This can happen because in school, female students learn better than male students. This finding is consistent with studies that have been conducted during the last 25 years that the teachers at the school as a whole to interact more positively with female students compared with male students, ranging from pre-school applies to universities (Jones &Dindia, 2004). This has resulted in the achievement of female students is better than male students. Because of the positive interaction between teachers and female students, the female students more motivated to learn, whereas negative interactions on male students resulted in male students are less motivated to learn. So that during the elementary through senior high school female students dominate cognitively compared with less than male students. Unlike when stepped on during college, due to the reduced interaction that exists between female students and teachers, the boys had a great opportunity to be able to demonstrate the ability of him that at this time the male students is more prominent than female students cognitively. But because this study only uses the subject students from elementary up to high school, the results show that girls appear more rational reasoning than boys are mostly still reasoning intuitively.

Gender differences should not be a comparison with high and low patterns of reasoning person. Informal reasoning is an individual reasoning that arises from every individual so that everyone has a different view and produce a different reasoning. The most important thing to do in developing the informal reasoning to extend knowledge and dig deep, because the level of informal reasoning person's influence on decision making. Obviously in making decisions did not want any party aggrieved. Thus the accuracy of decision-making is determined by informal reasoning used.

With the discussion of informal reasoning patterns generated by different gender, it does not mean focusing or favoring one sex. Basically developments in an individual does not always happen together, it is of course influenced by factors that exist in each individual. There should be no discrimination between the sexes, and to compare the cognitive processes that occur in perempuan and men, because it is supposed to do is eliminate the gender bias that occurs in both, because the main objective of the various processes that occur in an individual is how forming an individual that science literacy, which can account for all the decisions that have been made without prejudice to any party.

CONCLUSIONS

Researchers concluded that the development of informal reasoning on socio-scientific issues related to health in elementary through high school have diverse patterns. All categories of informal reasoning that is intuitive, emotive, and rational can be
At the primary school level categories that tend to appear informal reasoning is intuitive categories, then the SMP category tend toward rational informal reasoning, as well as at the high school level categories that tend to arise reasoning is reasoning. Changes in informal reasoning of intuitive towards rational in elementary through high school showed progress. Based on these results it can be concluded that the pattern of informal reasoning from elementary to high school to experience growth.

Gender produce a pattern of reasoning that is diverse in every level of education and at all levels of education. Based on the percentage of students of all levels of education (elementary to high school) on a matter concerning socio-scientific issues of health, informal reasoning that tend to appear in female students is rational reasoning, and reasoning are likely to appear on the male student is intuitive reasoning.

ACKNOWLEDGMENTS

We acknowledged Departemen of Biology Education, Universitas Pendidikan Indonesia. Dr. Phil. Ari Widodo, M.Ed., Dr. Riandi, M.Si., and Dr. Diana Rochintaniawati, M.Ed

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The Implementation Of Inservice Training-Based Lesson Study (Instals) To Improve Biology Teachers’ Hands On Abilities

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Abstract

One of the efforts to realize the quality of biology learning is to optimize the teachers’ hands on abilities are still relatively low. This study aims to determine the impact of INSTALS (in-service training-based lesson study) on the teachers’ hands on abilities. This study is a qualitative research that is designed using the lesson study principles included: plan, do/see, reflect) involving 28 teachers the member of association of biology teachers on junior high school (MGMP IPA biologi SMP) in Sragen. Data collecting used test and non-test techniques by observation, questionnaire, and documentation. Data were analyzed by descriptive qualitative and presented in the form of a diagram. The results showed INSTALS can improve: 1) teachers’ understanding of the nature of biology learning; 2) the biology teachers’ hands on abilities.

INTRODUCTION

Teacher is believed to be a key factor in the success of realization of quality education. Quality education can be realized only if it is supported by qualified teachers. The professional teachers are required to have 4 competencies are: professional competence, pedagogical competence, social competence, and personal competence (Teacher and Lecture Regulation, 2005). In the context of learning, the teacher demanded to teach biology appropriate means as part of a science that refers to: the process as a dimension of skill (hands on), the product as a dimension of content or knowledge (minds on), and attitude as the dimensions of the scientific attitude (hearts on) (Cain and Sund, 2009). Teaching biology is not the rote as transfer of knowledge from the teacher to the learner, but through a series of science process skills that encourage learners to construct knowledge through learning experiences as well as scientist working and training scientific attitude to students. Sobey (2014) states that if student do not learn science by hands-on activities, it’s mean that student have not learned the real science. Learning-based hands on activity can motivate students and engaged learning more actively. It is relevant to the scientific approach as mandated in 2013 curriculum that includes science process skills activities such as: observing, questioning, reasoning, investigating, and communicating.

But factually teachers’ hands-on ability is still low. The results of the prior of teachers’ hands-on abilities test showed an average value low (51.92). This is supported by the results of questionnaire analysis showed that only about 25% of teachers who actually teach biology-based science process skills, 75% of teachers teach verbally or transfer of knowledge. This conditions is due to many factors. Interviews by respondents showed that as many as 71% of teachers reasoned because the amount of material that must be taught while teachers are required completing the curriculum targets. 15% of teachers stated because infrastructure is less support, 15% said because of the difficulty in designing lesson plan-based science process skills. It is predicted related with teachers' understanding
about the nature of biology teaching and learning. The results of questionnaire analysis about the teachers’ understanding of the nature of biology teaching and learning showed: 93% of teachers are not the right answer, 7% less precise answer, and there is no right answer (0%). Given the importance of biology teaching and learning in accordance with the nature of science, the teachers’ hands-on abilities need to be empowered in order to create an active learning so that students enjoy in learning.

Improving the teachers’ competences can be done through various ways, one of which is through in service training. In Government Regulation No. 74 in 2008 stated that the activities of teacher professionalism can be done through a various programming including through the empowerment of the forum of subject teachers (MGMP). INSTALL (inservice training based on lesson study) is a training model in service training given to teachers through MGMP activities by using the principles of lesson study that refers to the four phases of activities: plan, do, check, action (PCDA). Through the PCDA activities teachers can learn from each other to improve their learning practices (Arani & Matoba, 2002). In the context of improving the professionalism of teachers through training, Hibi & Matoba (2004) states that the best training for teachers is through shared experiences and reflections through small group discussions and network. INSTALL models include: 1) First stage, plan which is in a group of teachers under the guidance of tutors (lecturers) are trained to identify the subject matter that is considered difficult and guided to make the lesson plan-based hands on activities. The teacher presented lesson plan in front of the class to criticize other groups and preparation for implementation in the class; 2) Second stage, do which is the model teacher who was elected to implement the results of the design of the lesson plan in the classroom; 3) Third stage, check which is teachers discussion under the guidance of tutor teacher talks to evaluate the design and implementation as a reflection of learning; 4) Fourth stage, actions which is teachers together to revise the lesson plan based on the input as the result of reflection.

INSTALLS is the excellence training model because of its effectiveness by utilizing MGMP can be done outside from the effective hours of instructional, so it does not interfered teachers and learners. In addition, the implementation of INSTALLS model can be a vehicle for collaboration between the institution of higher education and schools through community service (Pengabdian Masyarakat) activities. According to Okuda (1998), teacher quality can be seen from three aspects: 1) sensitive in responding and able to act appropriately to the circumstances; 2) able to collaborate in groups; 3) and able to develop their professionalism. Stages of reflection in the model of INSTALLS encourage teachers to make improvements quality of teaching. Departing from the above, then this model predicted strong very effective, because in addition to not interfere with the effective hours of teaching and learning activities, teachers can apply their training in teaching practice in schools directly. Thus the application of INSTALLS model expected to impact positively on improving the competence of teachers while increasing the teachers’ hands-on abilities.

**RESEARCH METHODOLOGY**

This study aims to determine the impact of INSTALLS (inservice training based on lesson study) model on the biology teachers’ hands-on abilities. This research is a qualitative descriptive study was designed using the principles of lesson study (plan, do, check, action), involving 28 teachers of the members of the teacher forum of science (biology) subject matter (MGMP) of junior high schools at Sragen. Data collecting by using test and non-test techniques through: test, observation, questionnaire and
documentation methods. Data were analyzed by descriptive qualitative method and presented in the diagram.

DATA ANALYSIS

The profile of teachers’ understanding about the nature of science teaching and learning before and after the implementation of INSTALS model as Table 1 and Figure 1 below.

**Table 1. The Profile of Teachers’ Understanding About The Nature of Science Teaching and Learning**

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Before Using The INSTALS Model</th>
<th>After Using The INSTALS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Good</td>
<td>0%</td>
<td>4.27%</td>
</tr>
<tr>
<td>2.</td>
<td>Moderate</td>
<td>10%</td>
<td>65.03%</td>
</tr>
<tr>
<td>3.</td>
<td>Less</td>
<td>90%</td>
<td>30.70%</td>
</tr>
</tbody>
</table>

**Explanation:**
Less = science (biology) as a product; Moderate = science (biology) as product and process; Baik = science (biology) as product, process, and scientific attitude.

![Figure 1. The Profile of Teachers’ Understanding About The Nature of Science Teaching and Learning](image)

Figure 1. The Profile of Teachers’ Understanding About The Nature of Science Teaching and Learning

Table 1 and Figure 1 showed that teachers' understanding of the nature of science teaching and learning is varied. Before using of INSTALS model, 90% of teachers to understand biology as a science products (knowledge as content). Only 10% of teachers who view biology as knowledge about the concepts of biology acquired through a series of scientific process. There is no (0%) of teacher who understand biology as a whole that are as processes, product, and scientific attitude.

The profile of teachers’ understanding about the nature of science teaching and learning-based improvement categories after using the instals model presented in Table 2 and Figure 2 follow.

**Table 2. The Profile of Teachers’ Understanding About The Nature of Science Teaching and Learning-Based Improvement Categories After Using The INSTALS Model**

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Changed</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A</td>
<td>Less → Good</td>
<td>3,846%</td>
</tr>
<tr>
<td>2.</td>
<td>B</td>
<td>Less → Moderate</td>
<td>57,692%</td>
</tr>
</tbody>
</table>
Proceeding International Seminar on Mathematics, Science, and Computer Science Education

3. C Moderate → Moderate 7,692%
4. D Less → Less 30,769%

**Explanation:**
A = True and precise; B = True but not properly precise; C = True and not changed; D = Not properly true and not changed.

**Figure 2.** The Profile of Teachers’ Understanding About The Nature of Science Teaching and Learning-Based Improvement Categories After Using The INSTALS Model

Table 2 and Figure 2 showed that the biology teachers' understanding about the nature of science teaching and learning-based improvement categories after using the INSTALS model was changed. The lowest percentage is the changed of category A (true and precise answer), the changed of the answer from less to good is only 3.846%. The highest percentage is the changed of category B (true but not properly precise) is 57.692%, the changed of the answer from less to moderate. While the answer has not changed (fixed) are in category C and D. Category C (true and not changed) is 7.692%. In the category D (not properly true and not changed) is 30.769%. That is despite the using of the INSTALS model able to change teachers’ understanding about the nature of biology teaching and learning, but the biology teachers’ understanding about the nature of teaching and learning who has not complete still high.

Profile of biology teachers’ hands on based-on categories before and after using the INSTALS model presented in Table 3 and Figure 3 follow.

**Table 3.** The Profile of Biology Teachers’ Hands-on Based-on Categories Before and After Using The INSTALS Model

<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Before Using The INSTALS Model</th>
<th>After Using The INSTALS Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>A</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>2.</td>
<td>B</td>
<td>10%</td>
<td>65.30%</td>
</tr>
<tr>
<td>3.</td>
<td>C</td>
<td>90%</td>
<td>30.70%</td>
</tr>
</tbody>
</table>

**Explanation:**
A = Very Good; B = Good; C = Moderate; D = Less
Figure 3: The Profile of Biology Teachers’ Hands on Based-on Categories Before and After Using The INSTALS Model

Table 3 and Figure 3 showed that the biology teachers’ hands on abilities based on categories before and after using the INSTALS model was changed. Category B (good), increased significantly from before and after using the INSTALS model (10% → 65.30%) it’s mean increased of 54.30%. Category C (moderate), biology teachers’ hands on abilities from before decreased (90% → 30.70%). It’s means that the biology teachers’ hands on abilities have increased after using the INSTALS model.

The average value of biology teachers’ hands on abilities before and after using the INSTALS model presented in Table 4 and Figure 4.

Table 4. Profile of Biology Teachers’ Hands-on Abilities Before and After Using The INSTALS Model

<table>
<thead>
<tr>
<th>No.</th>
<th>Aspect</th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Average value of Teachers’</td>
<td>51.92</td>
<td>68.30</td>
</tr>
<tr>
<td></td>
<td>Hands-on Abilities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 4. Profile of Biology Teachers’ Hands-on Abilities Before and After Using The INSTALS Model

Table 4 and Figure 4 showed there are average value of biology teachers’ hands-on abilities improvement was increased before and after using INSTALS model (51.9 → 68.30).
RESULTS

In general, the using of INSTALS model has not been able to make teachers’ understanding about the nature of biology teaching and learning be intact. However, the using of INSTALS model has given the positive impact on the biology teachers’ hands-on abilities. It mean this is a good prospect, because biology teacher with good hands-on ability expected their self-awareness will be grow to its understand and have an impact on the quality of learning.

DISCUSSION

In general biology teachers’ understanding about the nature of teaching and learning as a process, product, and scientific attitude is not intact, but there is improvement, although not optimal as expected. This is closely related to the characteristics of INSTALS model namely the hands-on activities of training material. The training materials were designed referring to the stage of lesson study is very effective in inducing changes in the biological understanding of the nature of learning and teachers' hands-on ability. Stages of planning (plan) in the early stages of lesson study. Under the guidance of tutor, teachers are trained to identify learning material, designing of lesson plan-based hands-on activities. During the activity, the teacher can ask questions, discuss, and express their ideas freely. Thus teachers acquired useful knowledge to increased their competences in teaching. These conditions are relevant to the discovery learning of Bruner theory (Dahar, 2011) where the scaffolding hold an important role in learning namely the number of assistance could be provided to learners in the early stages of learning the learner and subsequently take over greater responsibility as soon as the learner can do. This is supported by interviews with teachers stating that training is particularly useful to increase the stock of knowledge that is useful for teaching. Stages of implementation (do), teachers are trained to apply learning-based hands-on activities, the teacher got a lot of extra experience on hands-on based biology learning that they had never applied in the classroom.

Stages of observation (check), teachers get a new challenge when teaching practice in front of fellow teachers and can learn from each other. It is relevant to Vygotsky learning theory (Dahar, 2011) that learning is a process of knowledge construction as a result of interaction with the environment. Interaction with others, will spur constructing new ideas and improving intellectual development. It is also supported by Bandura learning theory (Dahar, 2011) that learning through models can provide inspiration for learners to improve their learning practices for the better. Stages of action (action), teachers can improve the design and practice of learning based on feedback from other teachers. These stages seem to be able to realize the trainees that through discussion teachers can learn from their environment. Teachers can learn how to learn from other teachers (Arani, S., 2011).

Besides building an understanding of the nature of biology teaching and learning, hands-on activities also encouraging the teachers’ science process skills. This is relevant to the purpose of biology learning as mandated in Curriculum 2013 through a scientific approach. Stage action, teachers revised their lesson plan based on input from others to encourage the teaching quality of teachers to be better. This is supported by research Darling-Hammond (2000) that teachers with extensive training and good preparation are more successful in interacting with learners than lack of training.
CONCLUSIONS

The implementation of INSTALS gave a positive impact on: 1) biology teachers’ understanding about the nature of biology teaching and learning was increased of good category (0→42.7%), moderate category (10% → 65.03%), less category was decreased (90%→ 30.70%); 2) biology teachers’ hands-on abilities was increased in the average value (51.92 → 68.30).

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Learning Vertebrate Zoology Taxonomy Through Approach Ethnozoology Project In Garut

Sriwahjuningsih

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Keywords:
taxonomy, zoology vertebrate, ethno zoology, local knowledge in Garut, biology student.

Abstract

Vertebrate zoology learning needs to be packaged in the form of practical activities that make the learning of textual be contextual, effective and beneficial. One form of contextual learning is doing a project that addresses the link between ethno zoology vertebrates in the area of origin of students with the science of taxonomy. Currently local knowledge began to be eroded by modernization and transformation of knowledge that is not well documented. Local knowledge is needed to understand biodiversity and community interaction with the environment. The research objective is to train students to describe and interpret ethno zoology vertebrates which include knowledge, utilization, how to obtain, distribution, protection of vertebrate animals and traditional values in society in Garut. The method used is observation and interviews with community leaders from the village of domicile students who are deemed to have local knowledge of culture and society interaction with the environment. The results showed that the obtained ethno zoology vertebrate communities contained in Garut include: 24 species of 7 orders for the class Pisces, 5 species from 1 order to amphibian, 8 species of 2 order for the class Reptiles, 20 species of 10 orders for the class Aves and 7 species of 5 orders for the class of mammals. Based on these results, it can be concluded that such contextual learning in the home environment ethnozoology project domicile students can help students make sense of the lessons are applicable by way of linking academic material with the context of their daily lives.

INTRODUCTION

Studies on the use of vertebrate animals in the local culture can be used as a tool in vertebrates taxonomy of learning for students. In addition to gaining knowledge about the distribution and identification of vertebrates, students also gain knowledge about the values and attitudes adopted by the community or the population of the local fauna communities that used them. The surrounding environment can be used as a practice or laboratory so that learning becomes contextual textual taxonomy (Subagja, 2006). Taxonomy of vertebrates is a subject which studied a wide variety of fauna, some of which are around the lives of students making it possible to apply the contextual learning. As each student's home region has a culture that is different and has its own peculiarities.

Society as a unit of life that utilize a variety of resources around them to meet their needs (Suparlan, 2005). Indigenous tribes that inhabit somewhere very familiar with biological resources in the community that have adapted and trained to use it (Indrawan et al. 2007). Utilization of animals is done by humans for food (Alves, 2012), clothing and tools manufacturing (Alves et al., 2009), the production of pharmaceuticals (Alves et al., 2010), and the practice of magical-religious (Alves et al., 2012). Modern scientists have learned a lot from the local community in understanding biodiversity and start digging
local knowledge have for centuries collected by various native tribes somewhere. Along with the development, unfortunately, local knowledge is beginning to shift even disappear eroded by modernization of equipment and transformation of knowledge, so that local knowledge is not well documented. Therefore, there developed a field of science that studies the relationship between animals and their utilization by a community group categorized as ethnozoology (Bol, 2004; Begossi & Silvano 2008).

Ethnozoology research in the area of West Java, especially in Garut very interesting, because the local people in Garut still practice traditional patterns in daily life. Based on this, the project research activities carried out by students from two classes were taking courses in the second semester of vertebrates taxonomy (2014/2015) with ethnozoology link between their areas of origin with the vertebrate taxonomy. The purpose of this study was to: 1) describe the taxonomy of vertebrate material that can be learned from the research activities ethnozoology project; 2) describe a variety of ethnozoology used in research activities ethnozoology student project; 3) analyzing the correlation between research activity ethnozoology project to the achievement of academic value.

**RESEARCH METHODOLOGY**

**Location and Time Research**

The research was conducted in Garut regency, West Java province is located in the Southeast part on the coordinates 6°56'49 - 7°45'00 south latitude and 107°25'8 - 108°7'30 east longitude. Garut regency has the administrative area of 306,519 hectares (3065.19 km²) or with a population density of 893 inhabitants per km². Garut district is divided into 42 districts, 21 villages and 403 villages. Sampling data from 13 sub-districts in Garut. The research activities carried out in the second semester of 2014/2015 in Biology Education Studies Program STKIP Garut.

**Methods and Materials Research**

The method of research was done on the naturalistic description of the situation as is and does not provide treatment for the observed effects. The research material in the form of data ethnozoology research project conducted by students from two classes of vertebrate taxonomic study subjects in the second semester 2014/2015. Title research project ethnozoology used as the data are 40 titles that discuss a variety of animals and objects ethnozoology in an area. In this study, also conducted quantitative data collection of pre test and post test results of students who follow the course of the vertebrate taxonomy.

**Data Analysis**

The method of analysis in ethno biological consists of two approaches, emic and ethics. Emic analysis is an approach that refers to the framework of local knowledge systems and ethics is an analysis that refers to the theoretical framework of scientific (Purwanto & Munawaroh 2002). The combination of both approaches will be obtained by a documentation that can explain the local knowledge of the angle of modern science (scientific), so it can be accepted logic. Although, there are some local knowledge (such as myths and legends) that is difficult to explain scientifically. Based on an analysis of research data on: 1) the material taxonomy of vertebrates that can be learned from the research activities ethnozoology project; 2) variance ethnozoology used in research activities ethnozoology project. 3) analyzing the correlation between research activity ethnozoology project to the achievement of academic value.

Material vertebrate taxonomic classification of animals by category (class and order) are the object of research along with examples of livestock. Variety ethnozoology analyzed
by type ethnozoology examined in accordance with the grouping by Alves (2012), the area
of origin of culture, along with examples of animals related to culture; correlation analysis
to strengthen and prove the difference between pretest and posttest among students
analyzed using correlation test and average test (z test). The average test formula is:

\[ z = \frac{(\bar{X}_1 - \bar{X}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \]

In this study, the hypothesis is built are:

- Ho = there is no difference in scoring on the student group.
- H1 = there is a difference in scoring on the student group.

The decision is based on:
1. If \( F_{\text{count}} \leq F_{\text{table}} \), Ho accepted or \( P_{\text{value}} \geq \alpha \) (\( \alpha = 0.05 \)), then Ho is accepted, which means there are no significant differences between groups of students.
2. If \( F_{\text{count}} > F_{\text{table}} \), Ho is rejected or \( P_{\text{value}} < \alpha \) (\( \alpha = 0.05 \)), then Ho is rejected, which means there is a significant difference between groups of students.

RESULTS AND DISCUSSION

Subject taxonomy of vertebrate zoology at the Department of Biology education
STKIP Garut, learn about the concept of diversity of animals Chordata (subphylum
hemichordate, Urochordata, Cephalochordata, vertebrates), the relationship phylogeny,
taxonomy and research activities and utilization of the science of taxonomy. Vertebrate
animals studied are generally classified into five taxa, namely Superclass Pisces, Amphibia
class, Reptilia class, Aves class, and Mammals class.

Results of research on vertebrate taxonomic description of the material obtained
from other research activities ethnozoology project undertaken by students of Biology
Education STKIP Garut include all classes in the subphylum Vertebrates, although only
cover certain orders (Table 1). Ethnozoology research results showed that all taxa can be
learned of its existence in the culture of society in Garut (Table 1). Superclass Pisces are
24 species of 7 orders, Class Amphibia are 5 species of 1 order, Class Reptilia are 8
species of 2 order, class Aves are 20 species of 10 orders, and Class Mammals are 7
species of 5 orders. This activity is consistent with the statement Jhonson (2010) which is
independent research ethnozoology which is a form of contextual learning that gives
students the opportunity to strengthen their awareness of the surrounding environment.

Table 1. Material zoological taxonomy of vertebrates that can be learned from the project
research activities ethnozoology

<table>
<thead>
<tr>
<th>No</th>
<th>Class</th>
<th>( \sum ) Research from 40 studies</th>
<th>Order</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pisces</td>
<td>12</td>
<td>1. Perciformes</td>
<td>Osphronemus goramy (ikan gurami), Oreochromis niloticus (ikan nila), Euthynnus affinis (ikan tongkol), Oreochromis mossambicus (ikan mujair), Rastrelliger kanagurta L (ikan kembung), Lutjanus sp (ikan kakap merah), Trichogaster pectoralis (ikan sepat), Anabas testudineus (ikan betok), Acanthocyblum solandri (ikan</td>
</tr>
<tr>
<td>No</td>
<td>Class</td>
<td>∑ Research from 40 studies</td>
<td>Order</td>
<td>Example</td>
</tr>
<tr>
<td>----</td>
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<td>---------------------------</td>
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<td>-------------------------------------------------------------------------</td>
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<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Amphibia</td>
<td>4</td>
<td>Cypriniformes</td>
<td>2. Cyprinus carpio L (ikan mas), Colossoma sp. (ikan bawal), Osteochilus vittatus (ikan nilem), Carassius auratus (ikan koki), Puntius tetrazona (ikan sumatra)</td>
</tr>
<tr>
<td>3</td>
<td>Reptilia</td>
<td>4</td>
<td>Malacopterygii</td>
<td>3. Chanos chanos (ikan bandeng)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Ostariophysi</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>Clupeiformes</td>
<td>4. Stolephorus sp (ikan teri)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td>Synbranchiformes</td>
<td>5. Monopterus albus (belut)</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td>Pleuronectiform</td>
<td>6. Pseudorhombus arsius</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td>Amphibia</td>
<td>2. Occidozyga lima</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Anura</td>
<td>Fejervarya limnochari</td>
</tr>
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<td>Fejervarya cancrivora</td>
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<td>Bufo. melanostictus</td>
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<td>Rana chalconota</td>
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<td>Reptilia</td>
<td>3. Crocodilus porosus</td>
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<td>1. Crocodilia</td>
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<td>2. Squamata</td>
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<td>Aves</td>
<td>4. Pycnonotus aurigaster</td>
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<td>1. Passeriformes</td>
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<td>3. Columbiformes</td>
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<td>4. Accipitridae</td>
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<td>5. Anseriformes</td>
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<td>6. Galliformes</td>
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<td>7. Falconiformes</td>
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<td>8. Sturnidae</td>
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<td>3. Artiodactyla</td>
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<td>4. Lagomorpha</td>
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<td>5. Perissodactyla</td>
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<td>Mamalia</td>
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According to Alves (2012), the relationship between humans and animals have existed since ancient times, and has been expressed in different ways, reflecting the effect arising from both the environmental and cultural conditions. A single species can be used in different ways and for different purposes by different people, depending on the proposed use and the related cultural aspects. In general, the animals interact with humans because of their usefulness or their habitat due to the intersection between the settlements. Moreover, many stories, myths and proverbs have been generated from this relationship and passed down from generation to generation through oral tradition, which affects how the local people relate to animals.

From the results of data collection ethnozoology by students in Garut, can be learned in six varieties ethnozoology on the relationship fauna and culture of the people, namely food, pets, symbols / myths / religious / cultural art, ornament / decoration / equipment, energy utilization and animal collection (Table 2). Through this ethnozoology study students are expected to learn about the communication between researchers and the agents responsible for the elaboration of wildlife management plan and the local human population. Alves and Souto, 2010 revealed that it is extremely important fundamental for the development of efficient conservation strategies.

Table 2. Variety ethnozoology used in research activities

<table>
<thead>
<tr>
<th>No</th>
<th>Variety of Ethnology</th>
<th>Σ Research from 40 studies</th>
<th>Studies project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Culinary</td>
<td>5</td>
<td>1. Variety of vertebrate animals used as food ingredients in Garut</td>
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<td></td>
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<td>2. Variety of species of fish around the coast Rancabuaya</td>
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<td>3. Type of fish consumption in the district of Garut Kota</td>
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<td>4. Kind of fish is the most widely used in restaurants in the district of Garut Kota</td>
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<td>5. Morphology rabbits for consumption in the District Cipanas tourist attractions Tarogong Kaler</td>
</tr>
<tr>
<td>2</td>
<td>Pets / Conservation</td>
<td>5</td>
<td>1. Types of fish fresh existing in Sukaresmi</td>
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<td></td>
<td></td>
<td></td>
<td>2. Kind of birds that sell in Garut City</td>
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<td>Java Eagle conservation studies (Raptor sanctuary) in Garut Kamojang</td>
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<td>4. Variety of types of cattle in Cilawu</td>
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<td></td>
<td>5. Variety of fish species in the district of Garut</td>
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<tr>
<td>3</td>
<td>Symbols / myths / religious / cultural arts</td>
<td>20</td>
<td>1. Variety fauna the used in traditional events in Garut</td>
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<td>2. The myth circulating in the region Kampung Pulo</td>
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<td>3. Traditional treatment of fish and eels in Kampung Naga</td>
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<td>4. Ethnozoology eels in the tradition of salvation seven months in Bayongbong</td>
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<td>5. Variety of fauna in naming places on the south coast of Garut</td>
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<td>6. Chicken pest control as well as the bans available in Kampung Naga</td>
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<td></td>
<td>7. Variety fauna the used in traditional events in Garut</td>
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<td>8. Market sheep as a cultural city of Garut</td>
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<td>9. Study ethnozoology in Bagendit</td>
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<td>10. Chicken as pest control in the village of Naga</td>
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<td>11. Study ethnozoology of the martial arts in the region Samarang</td>
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<td>12. Local knowledge of fish in the temple Cangkuang</td>
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<td>13. Studies on family ancestry ethnozoology Batsuwangi</td>
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<td>14. Study the behavior of fauna diversity implies.</td>
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<td>15. Philosophy symbol vertebrate animals in Garut</td>
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<td>16. Study of arts and culture in the area Cibatu-Wanaraja</td>
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<td>17. Ethnozoology vertebrates around the tomb of the Holy Godog</td>
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<td>18. Symbols and cultural values in the area Singajaya</td>
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<td>Identification of sheep Garut in the tradition of martial arts and</td>
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<td>19. pitting in Wanaraja</td>
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<td>20. Study area name that has meaning animals in Garut</td>
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<tr>
<td>4</td>
<td>Ornament / decoration / equipment</td>
<td>4</td>
<td>1. Variety of vertebrate animals exist in the decoration in Garut district</td>
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<td>2. Variety Fauna in batik motif Garutan</td>
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Bandung, October 17th, 2015
The end result of this study is to analyze the relationship between the research activities ethnozoology project with the achievement of the academic value of the two classes. Data show that there is an increase in the value of students' academic achievement in the subject of taxonomy of vertebrates. In the A class, students who have increased the value of pre-test to post-test as much as 73%, and decreased 27%. As for the B class, students increase in the value of the pre-test to post-test by 77%, and decreased 23% (Figure 1A and 1B).

![Figure 1. Percentage values academic achievement based on the pre-test and post test (A = students of class A; B = students class B)](image)

Analysis using the average test or z test amplifies a significant difference between the pre test and post test. Z Test results showed that the count is smaller than z table. On the class A, shows that there are significant differences between the pre test and post test ($z$ count = -2077 < $z$ table = -2002) then it can be assumed that the research project ethnozoology help improve the absorption of the material taxonomic zoology students in class A. Results analysis performed on class B, shows the same results as in class A the count $z$ = -2282 < $z$ table = - 2002). This is reinforced by results of correlation with the value of 0.71 to 0.70 for the class A and class B. This value indicates that there is a strong relationship between research activities ethnozoology project with a value of student achievement in the learning taxonomy of vertebrates The results are consistent with the statement Johnson (2010), that contextual learning helps students find their own meaning in their lessons by connecting the academic material in the context of their daily lives.

CONCLUSIONS

The conclusion of this study were: 1) the material taxonomy of vertebrates that can be described by the students directly from research activity ethnozoology project is matter piscis, amphibians, reptiles, aves and mammals; 2) variance ethnozoology used in project activities ethnozoology among other animals for food, pets, symbols / myths / religious / cultural art, ornament / decoration / equipment, energy utilization and animal collections; 3) research activities ethnozoology project helps improve the absorption of the material
taxonomic zoology students in two classes, and affect the achievement of academic achievement scores, especially in subjects taxonomy of vertebrates.

REFERENCES


Development of The Complexity of Student’s Argumentation on Socioscientific Issue

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¹,²Universitas Pendidikan Indonesia

Abstract

The Student’s argumentation can be raised and developed using socioscientific issues. Socio-scientific issues about health is one of the social problems that the subject of public debate. This study aims to describe the development of the complexity of the arguments in elementary school, middle school, and high school. The three level of education is a school which is shaded by one of the Foundation in Bandung. Participants involved in the study consisted of 31 elementary students, 14 middle school students, and 23 high school students. Data taken using a quisioner consist of five items concerning socioscientific issues as well as individual interviews based on the answers to the test written description. Data identified using Toulmin Argumentation Adaptation Pattern (TAP), which consists of four levels, namely, level 1 (claim), level 2 (claims, data and / or warrants), level 3 (claims, data / warrant, backing), and level 4 (claims, data / warrant, backing, qualifier). The results showed that the development of increasingly rising complexity of arguments according to their level. The complexity of the arguments on elementary students reached level 2-3, middle school and high school reached level 3. Percentage of level 3 more ascending towards the middle school to high school. Meanwhile, if viewed from the argument that dominates the category level, level 2 emerged as the dominant category in elementary school, middle school, and high school.

INTRODUCTION

The development of civilization today are often faced with a myriad of problems, dilemmas and riddles about what we need to make decisions and choices. In modern society, many problems arise based on the results of the development of science and technology. A number of problems are known as sosiosaintifik issue. Sosiosaintifik issue is an issue that is based on the concept or scientific problems, controversial in nature, be a public debate in the community, and is often subject to political and social influence (Sadler & Zeidler, 2005). One important outcome of science education in schools is to enable students to use their understanding of science to contribute to the public debate and making wise decisions about issues that affect their lives (Sadler & Zeidler, 2005). Currently the students are faced with a choice with regard to their personal health and well-being. They should be able to make choices or decisions for example about how to deal with issues relating to energy resources are limited, the quality and quantity of water, pollution and population control (Driver et.al 2000). In the implementation in education, sosiosaintifik issue has become important in science education because it occupies a central role in the process of scientific literacy (Venville & Dawson, 2010). Science literacy requires the ability to discuss, interpret the relevant evidence, and make conclusions in response to issues sosiosaintifik. Driver (2000) said, including socioscientific issue in the learning process is essential in order to produce people who are responsible, able to apply scientific knowledge, as well as having the ability to thinking.
Inch (2006) stated that critical thinking is a process whereby a person tries to give a rational answer to the question that can not be easily answered. The answer from critical thinking is generated based on the person's ability or previous experience. Before someone can answer questions, draw conclusions, and make a decision, such a person should be able to weigh the risks and benefits, raise questions, and evaluates the integrity of the acquired information (Dawson & Venville, 2009). As a consequence of the decision-making process, arguments and argumentation skills play an important role in the formal reasoning (Sadler & Zeidler, 2005). The argument in the sense of everyday life, might conceivably be a picture of people in a discussion or dialogue is contradictory. The argument in discussion or dialogue can emerge one of them in response to the context of the socioscientific issue (Dawson & Venville, 2009). In this case the argument can be used to give a reason for challenging problems and layered. (Dawson & Venville, 2010). In accordance with that put forward by Kuhn (Venville & Dawson, 2009) defines the argument as a statement with justification. Means & Voss (Venville & Dawson, 2009) also describes the argument as a conclusion that is supported by at least one reason. Then, (Sampson & Clark, 2008) distinguishes arguments and arguments by using the term 'arguments' to describe products reasoned students in making and justifying the claim; and the term 'arguments' to describe a complex process. Sadler & Zeidler (2005) also states that the argumentation skills is seen as "external expression of formal reasoning". So if we take the conclusions from the statements of researchers, that the main component of science education that will help students make decisions now and in the future is the process of argumentation (Driver et al, 2000).

The development of the use of argumentation in science education is reflected in the work of Toulmin. Toulmin developed a model that describes the component argument or the argument that the structure can be used both for teaching students and teachers, argumentation skills, and also to analyze or evaluate the student's argument. The main components of the model Toulmin argument is: claim (conclusions, propositions or statements); Data (evidence supporting the claim); warrant (an explanation of the relationship between the claim and data); backing (base to support the assumptions underlying the warrant); qualifiers (certain conditions in which the claim is true); and rebuttal (a statement that denies an alternative or opposing claims, data, and warrants) (Dawson & Venville, 2010). At the time of the current education, students are expected to be actively involved in the debate on the topics that appear in accordance with the scientific community that they have to build knowledge. This is in line with the objectives of science education that no longer sees the students as passive participants, researchers as inventors, and the teacher as a conduit of information (Driver et al, Oulton et al., Dillon et al., & Sadler et al., Venville, 2010).

According to the research, showed in general, individuals of all ages are still experiencing difficulties in building a good argument (Driver et al., 2000). In addition to the functions sosiosaintifik issues that can raise the argument of reasoning one to make a conclusion or justification, understanding the concept also has a relationship with a person's ability to argument. Based on numerous studies of the argument, there is also a link between the argument with one's understanding of science. The relationship between arguments and understanding of the concept can be considered as two-way. First, the level of students' understanding of a concept can affect the quality and complexity of the arguments that they build. Secondly and conversely, the quality and complexity of the arguments that students can affect students' understanding of a concept of understanding (Venville & Dawson, 2009).Several studies have been done on the relationship first, namely, the impact of understanding on the quality and complexity of the arguments. Sadler (2004) concluded that a quantitative increase in knowledge may lead to the
increased amount of justification that students make in an argument. More recent research shows mixed results. According to Lewis and Leach (2006) in his research shows that high school students can engage in argument after being intervasi learning to develop content knowledge required. Similarly, (Aufschnaiter et al, 2008) found that an important factor when students are engaged in activities in class argument is the experience and knowledge of students on the content or certain concepts that previously owned.

Based on the research problems outline above, two research question guided the design and implementation of this research:

1) How does the complexity of the arguments on education elementary school, middle school, and high school?

2) Does the complexity of the pattern of development in accordance with the arguments show increased levels of education?

**RESEARCH METHODOLOGY**

Design This study was a descriptive study, as it aims to investigate the circumstances, the conditions, the results are presented in the form of research reports. This study aims to describe the development of the complexity of the arguments that occur with increasing levels of education. Studies evaluating the development of the complexity of this argument is done by using cross-sectional approach. Cross-sectional approach is an approach used in the study of child development committed against some groups of children with different age levels. Thus the research can be done in a relatively short time Heterington & Parke (Desmita, 2012). The location of research is Elementary School (ES), Middle School (MS), High School (HS) at one of the Foundation School in Bandung. In this study encoded Location For Schools LS. Researchers assume that the ES, MS, and HS shelter on the same foundation is expected to have a school environment and learning environment together so as to minimize the external factors that can affect students' patterns of argumentation. The study population used in this study were all students of 5 th grade, 8th grade and 11th grade high school junior majoring in science in schools that have been mentioned in the study site. Selection of grade levels for the purpose of considering the knowledge and understanding of the concepts Siwa Biological material was chosen on which to base a given instrument.

The research instrument used is in the form of an open questionnaire and interview sebgai validity of the students' answers. The instrument is made to be applicable to students from elementary, junior high, and high school. Instrument in the form of an open questionnaire consisting of five questions that consist of different issues, but still within the scope the same theme is the theme of health. Each question contains three children as a framework about the actual arguments have the same goal which is to bring the student's argument with the questions inducement. All questions given on the third level is the same, but differ on delivering a more modest rate of ES level. The following is a description of the grating instruments used in this study. Arguments students of each question are identified then categorized based on the argument that component appears. Component argument used is adaptation scheme Toulmin's Pattern Argumentation (TAP), which consists of 4 category level. This is adaptation scheme Toulmin's scheme Argumentation Pattern (TAP) by (Venveile & Dawson, 2009) are as follows.
TABLE 1. Levels, description, and example of argumentation patterns

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Example</th>
</tr>
</thead>
</table>
| 1     | Claim (statement, conclusion, proposition only) | It should not be [ES]  
Do not, because they contain artificial preservatives [MS]  
May, if not excessive provide preservative [HS] |
| 2     | Claim, Data (evidence supporting the claim) and/or Warrant (relationship between claim and data) | Disagree. Supposedly farmers do not use preservatives (claim)  
Since the use of preservatives can be toxic to the consumer (data) [ES]  
Yes, it is okay as long as it is not too often eat it (claim). If it is too often makes endanger the child's intelligence (data), dangerous if consumed every day (warrant) [MS] |
| 3     | Claim, Data/Warrant, Backing (assumption to support warrant) atau Qualifier (conditions under which claims are true) | Disagree, (claim) because it can lead to various diseases (warrant). The provision of food preservation wax on apples, giving peptisida on vegetables (data). Do not take action to export fruit and vegetables again, it's better to make or grow in their own country (claim). [HS]  
May, but do frequency (claims). Because nuggets, sausages, etc contains MSG (data). Better mother outsmart healthy food made doll picture so that children want to eat (qualifier) [MS]  
Not good (claim), because fruits and vegetables are very necessary for the human body. Too much food as it is not good for the body because it can affect the health of the child and the child's intelligence (data / warrants). If the mother still provide food like that then their children can not develop properly (backing). [HS] |
| 4     | Claim, Data/Warrant, Backing, Qualifier | Disagree (claim). Mixing his food with vegetables, or take vitamin fruit 18 junior in pharmacy (qualifier). Because nuggets, sausages, fried chicken contains MSG that endanger health (data / warrant)  
Looking at the example beberpa / child obesity due to junk food (backing) [MS]  
Disagree (claim). Preservatives have substances that are not good for the body if consumed frequently will cause serious illness (data / warrants). Because the use of preservatives can trigger cancer (backing). Because many adverse events, there may be other alternatives are better and healthier as the use of natural dyes (qualifier) [HS] |

RESULTS AND DISCUSSION

The complexity of the arguments in the es, ms, and hs results obtained from the data provision descriptions five questions sosiosaintifik issue with the health theme and interviews are useful to validate the students' answers on questionnaires open. The whole of the students' answers to each question are identified and categorized based on four categories of levels: level 1, level 2, level 3 and level 4. Other categories can then arise based on the categorization of the students' answers as it is. Data that has been categorized for each question on each student then drawn conclusions most dominating level of overall student answers the question. There are level 1-2 (dominating at level 1 and level 2) and level 2-3 (dominating at level 1 and level 2). Here are the results of data analysis based on the complexity of the arguments students sosiosaintifik issue in es, ms, and hs.
The complexity of the arguments at ES in the category of level 2-3. Level 2-3 This is the category which raises two dominant level by the same amount, namely level 2 and level 3. Joint dominance showed that the level of ES students have started at least have the ability to argue using the argument that the more complex components, namely, achieving level 3. Components of a more complex argument is an argument that consists of a claim, the data / warrants, and backing / qualifier. Although the level 3 has begun to appear on the ES level apparently is not dominating presence of other lower level (level 1 and level 2). This is evidenced by the percentage level of 2-3 indicates that most small percentage compared to other complexity level lower than the level of 2-3. Level 2 is the category with the highest percentage among the other level. Level 2 dominates more than half the number of elementary school students. This indicates that the majority of primary school students are able to provide an argument with the claim is accompanied by the truth of the components in the form of data or data and warrants. The fact of the results of this study turned out to be in line with research conducted (Osborne, 2004) i.e. at students aged 12 to 13 years old (elementary school students) showed that the level of the most widely arguments appear is at level 2. However, the category of level 2 on Osborne’s research smoothly in the analysis of its components, namely the argument component consists of a claim by the data, warrant or backing (Dawson, Venville, 2010).

The complexity of the arguments on the MS is in the category level 3. Compared with ES, MS category at the third level started to dominate the argument some MS students, though still with a smaller percentage than the other levels. At the MS level, the level of 2-3 still appear with a percentage increase from the percentage achieved Level 2-3 ES level. It shows that at the MS, some students start and was able to argue with a more complex coverage. Students are able to provide a reason truth and used reasoning on the claim made. Supporting reasons that corroborate the claim may consist of data / warrant, backing or qualifier. And the other hand, the complexity of the arguments at the high school level in the category level 3. It shows also that the complexity of the arguments on the MS and HS are at the same level. However, at the HS level 3 level category turned out percentage is increasingly rising levels lower than MS. The increase in the percentage can be influenced by cognitive factors which are essentially high school students and should have the knowledge and experience deeper kuhususnya in science. Level 3 includes the components of the claim, the data / warrant, backing, and qualifier. Then students at HS level has been able to provide additional supporting reasons such as backing and a qualifier in his argument.

The development of complexity argument is based on Figure 1 illustrates an increase in line with levels in ES, MS, and HS. According to the previous assumption that with

**FIGURE 1.** Level of Argumentation expressed in statements by students in Elementry School, Middle School, and High School
increasing levels of education, it also develops the complexity of the arguments that led to the argument that a higher level in accordance with the level of hierarchically. Elementary school students were able to demonstrate the achievements of the most complex level in two dominant level (level 2-3), which later evolved to the SMP which is at level 3 and growing percentage of level 3 ascending the high school level. In this study, three achievement levels did not dominate the complexity of the arguments for the student. Level students who dominate the argument of the third level is the level 2. Level 2 consists of claims, data and / or warrants. So it seems in line with various studies examined by Dawson & Venville (2009, 2010 & 2013) which states that the results of the research showed that in general students do not use the data, or use the data / simple warrant in favor of truth claimnya.

Although the level 2 dominate the complexity of the arguments of all three levels. It turns out when viewed from the arguments of all three levels of the students showed progress. Various factors can affect the words, ideas, ideas expressed in the sentence argumentation students. These factors include the god of cognitive development, language development, the development of critical thinking, to influence the learning performance or unfamiliar argument explicitly.

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Bandung, October 17th, 2015


Student Ethical Reasoning Development in Level Education Elementary School (ES), Junior High School (JHS) and Senior High School (SHS) About Socioscientific Issues

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Article info

Abstract

Rapid technological developments have a major impact to the community especially in social-science (Socioscientific). One of the central socioscientific issues which now become the subject of discussion is transgender that will probably raise the social conflicts community. Ethical reasoning can be used as one of the basic socioscientific issues reviews. The aim of this researching to find out how the development of ethical reasoning against gender influence students at every level of education. Ethical reasoning in this study are grouped into three stages, argument based on personal interests (novice), argument not just personal interest but also pay attention to the importance of social (middle), and argument based on the interests of the social (advanced). Data obtained from 8 elementary, 28 junior high and 22 senior high school students at one education foundation in Bandung city. Instruments is a written test which contains issues and questions so that analysis is carried out based on the response of students. In addition, interview is also conducted individually for validation of the arguments. The result showed that the absensce of the development of ethical reasoning between level education. The result of this research also suggest that gender may influence on the development of ethical reasoning in male students more dominant on novice compared to female students which are more dominated middle and advanced.

INTRODUCTION

The rapid development of science and technology in this century have contributed significantly in human life. In addition to providing various facilities as the impact of its application, science and technology also gives some negative impact on human life. The application of science and technology that are not controlled and do not pay attention to the moral norms in society will increase the creation of social problems and environmental problems. Social issues based on science and technology, both in the study of the concept, process and application of technology, Sadler (2009) have called socio-scientific issues (Socioscientific Issues).

Socio-scientific issues arise because of the correlation between social science and, not only the object of study is controversial but also contains a variety of risks and usually quickly spread by exploiting media berbaga (Berne, 2014). In a short time would be divulging the main topic of conversation among the public, such as various isuu transgender, a certain number of cases of cloning as well as a variety of transgenic crops. Socio-scientific issues involving an individual is a serious study because it means forcing these individuals to be able to act or make decisions based on its reasoning. This means that an individual should have good reasoning power so that it can cope with the problem appropriately.
According to Sadler (2004) one of the goals of science education is to improve students' ability to handle a wide range of socio-scientific issues. This can be the basis of reason that the increase in students can be integrated in the curriculum as a good reason to be in line with the precision of the students in taking a decision. The use of socio-scientific issues will support students to practice thinking skills when making a decision with due regard to other aspects. In addition, socio-scientific issues will also familiarize students to continually develop the mindset as the impact of the process of reasoning. Reasoning as a basic form of a thought process can manifest in several forms, one of which ethical reasoning.

Ethical reasoning is a reasoning based on the views of values and norms in society to a problem or issue that became the topic of conversation or debate, in this case, including socio-scientific issues. Issues of socioscientific rarely in the lift in the learning process as an ingredient in training students to be able to reason in solving a problem. In fact science has now become the basis for a variety of contexts in the scope of the community. It hamper the development of students due to lack of trained reasoning ability of students while attending formal learning.

This study aims to identify the development of students' ethical reasoning on socio-scientific issues related to biotechnology in elementary, junior high, and high schools in the foundations of education in the same area. So hopefully with the results of this study can be identified the level of development of moral education which is owned by the students because of the development of reasoning ethics will be in line with the development of moral education, can be the basis of the integration of moral education in the curriculum, and can prepare students to be directly involved in the life of society, and overcome various problems that arise due to the development of biotechnology is based on the reasoning that has been owned.

**METHODS**

The method used is quantitative descriptive because it aims to create a true gambarar regarding the subject under study based on data in numbers. Model research is cross-sectional, which means that researchers use the same object of study at various levels simultaneously and at the same time. The study involved 8 elementary school students, 28 junior high students, and 22 high school students who are at the foundation of education in the same area.

The instrument used in this study is a written questionnaire and interview guide students. Data obtained from written tests and interviews were analyzed with reference to the indicators put forward by Jones et. al. (2007) in Berne (2014) with some modifications to fit the research questions that have been submitted. Here is presented a table containing ethical reasoning development indicators proposed by Jones et. al. (2007).

<table>
<thead>
<tr>
<th>Original Indicator (Jones et. al. (2007))</th>
<th>Modification (Novice-Advanced)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal – peers – national – global</td>
<td>Personal – Social</td>
</tr>
<tr>
<td>Immediate consequences – now consequences – long term consequences</td>
<td>Immediate consequence – long term consequence</td>
</tr>
<tr>
<td>Uses existing knowledge only – use taught knowledge – researches new knowledge</td>
<td>Use existing knowledge only – research new knowledge</td>
</tr>
<tr>
<td>1 frameworks – 2 frameworks – 3 or 4 frameworks – evaluate usefulness of frameworks for different situation</td>
<td>1 frameworks – 2 or more frameworks</td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSION

The development of students' ethical reasoning on socio-scientific issues in this research the data obtained from interviews and problem descriptions for each student at the education levels of Elementary School (ES), Junior High School (JHS), and High School (SHS). Results of interviews and about this description can determine the level of development of every student at every level so that it can become a basis for determining the presence or absence of reasoning development of students. As for the data can be described in detail as follows.

A. Development of Ethical Reasoning on Elementary, Junior and Senior High School.

Previous explanation has to review the ethical development of students at every level of education from elementary, junior, and senior high school. Elementary school students are more likely to balance between the level of novice and advanced level, but the students have started to learn how to blend in with their environment and develop their knowledges.

1) Development of Ethical Reasoning Based Student Public Interest

Figure 1.1 Explains the ethical reasoning that the percentage of students at every level from elementary through high school education as a whole did not show a regular pattern of progression from novice level to advanced level direction. Even so, the pattern of reasoning at every level changes. At about the nature of public interest, it is seen that the...

Figure 1.1 Percenteation ethical reasoning development in level education ES, JHS, and SHS based on social interest

Junior high school students suffered setbacks in which ethical reasoning novice level higher than the advanced level may be due to their lack of ability to apply knowledge-knowledge that has been held in response to everyday problems. Increased ethical reasoning occurs in children between the high school where the level is more dominant and advanced levels also have a fairly high percentage that indicates that the ability of students will increase in line with their ability to socialize. High school students considered to have a range of environmental and broader social life when compared with high school students. Ethical reasoning the overall development of each level can be obtained with regard to how the development of each level in each level. The following will be discussed on the development of ethical reasoning education students in elementary, middle, and high school in accordance with the nature of matter including on common interests or personal interests.
novice level decreased significantly from elementary to senior high school. Although the JHS increased slightly, but it is not too significant.

Level between shows an increase from elementary through high school. This means that high school students are better able to process the knowledge that they have so often confused in its use. In contrast to elementary students whose thinking is still heading in one direction only and so there between the level at this stage. At the advanced level fluctuation is not patterned between elementary through high school. Continued low level at primary school level but decreased in junior high school. However, when seen at the high school level, the percentage of advanced level of return has increased.

In accordance with the nature of the problem is that the public interest, it can be concluded in general that the advanced level increased positive so this means that students can carry out every stage of its development. An increase in students' progress is closely related to the theory of cognitive development proposed by Piaget. Cognitive development begins from the preoperational stage (at the elementary education level), the concrete operational stage (at the junior high school level), and the formal operational stage (at the high school level).

The ability to reason a person can be influenced by cognitive development that occurs with age. In addition, the development of students' reasoning in ethical reasoning is also related to moral development proposed by Kohlberg which is also an extension or modification and redefinition on Piaget's theory. Moral development theory suggests that children are growing through social interaction, but this interaction has a special feature in which personal factors that come into play activities. Kohlberg (in Desmita, 2009) divides moral development into three major groups, namely the level of prakonvensional morality (elementary) where children know morality is based on the impact caused by an act, which is pleasant (reward) or painful (penalty) and children do not break the rules for fear of punishment from authorities, conventional level where children will assess the merits of an act if it meets the expectations of the community or peer group, and the post-conventional level which emphasizes that the child will obey the rules that exist as a guide in living her life.

The data obtained in this study is consistent with the theory of moral development and cognitive development that has been described previously. A matter which concerns the public interest in the research intention is to use the subject matter of the problems concerning the interests of other people who have a fairly distant relationship with the student's personal self interests or concerns of community life. If the novice level in this aspect and more advanced low height, it can be ascertained that the individual can view or address a problem with ethical reasoning well.

2) Development of Ethical Reasoning Students Based on Personal Interests
Figure 1.2 Grafic of Percentation ethical reasoning development in level education ES, JHS, and SHS based on Personal interest

Social groups that are private interests emphasize personal interests as the main subject or make the subject matter closely related to students' lives and the environment. This problem groups using words parables, for example, "what if your sister", "what if you become a mother" or the words "what if your friend" as a marker that the question related to the environment close to the students. The purpose of this question is to look at the influence of the subject matter of the use of students' ethical reasoning to a case.

In Figure 1.2 it appears that there is a difference between the pattern of development in the matter of public interest and a matter of personal interest. When the matter of public interest group level experienced an irregular pattern is the advanced level, the opposite is actually happening in the private interest groups. novice level experienced an irregular pattern where primary school students proved to have better reasoning because the novice lowest level. Novice level is a level that is more oriented to the self-interest so that this means more elementary students to consider the public interest than its own advantages in addressing a problem.

Increased levels between with increasing levels of education shows that students in the foundation can develop knowledge and use it to respond to the problems of everyday thought gradually. Advanced Level on personal interests showed a decline. This is not in accordance with the theory of moral development that has been in the mentioned previously. A decrease in the advanced level indicates that the student has developed backwards from elementary to high school level. This setback does not mean that high school students who would have thought such as elementary, but this means that students have moral progress quite rapidly during the primary but ability have been obtained previously not used properly or do not know the time of its use and can not connect knowledge-knowledge has become a concept intact.

The cause of this decline can arise from a variety of things in the immediate environment of students or other environment surrounding students. some of which are state of the student learning environment that is less conducive, the lack of the ability of students to absorb all the knowledge that exists in daily life, the lack of guidance and teacher, student environmental conditions play well with their peers or with the community in its immediate environment. These factors will determine the level of ethical reasoning which is owned by the students.

B. Development of Ethical Reasoning Students by Gender

Gender is one of the important aspects that affect social development in the early years children. Most children experience at least three stages in the development of gender (Shepherd-Look, 1982). First, children develop beliefs about gender identity, that sense of male or female. Second, children develop gender distinction of sex where they want. Third, they gain permanence gender, a belief that a person's sex is biologically determined, permanent and unchangeable. Lately, a gender schema theory to explain the development about knowledge of child gender. Thought gender schema, a child develops through a series of stages in an effort to determine attitude expected by society.

The development of knowledge of gender is influenced by several things, namely biological influences such as the existence of different hormones in men and women, social influence that can determine the nature and attitudes of women and men in accordance with its role in society and influence cognitive stressed that the individual is actively world construct their gender. Based on this, the authors analyze whether there is
influence of gender on the development of ethical reasoning of students at every level of education from elementary, junior high and high school.

Observation, imitation, reward, and punishment is the mechanism by developing gender in social cognitive theory. The interaction between the child and the social environment is the key of the development of gender in this view. An individual experiencing gender determination since in the womb but gain knowledge about the role of gender that begins when the individual has entered the age of 2-6 years. Here’s a chart the development of ethical reasoning based on the gender of students at every level of education.

![Chart showing the development of ethical reasoning based on gender](chart.png)

**Figure 1.3** Percentate ethical reasoning development in level education ES, JHS, and SHS based on gender

In general, it can be concluded that the ethical reasoning of women have a higher level than the male students. In Figure 1.3 can be the cause of a better development in female students. When considered as a development, it can be analyzed that initially the percentage of female students have a high novice level, but the percentage level is higher among female students than male students so the impact of advanced levels of female students is higher as well. The high percentage of level between the students showed that more women can live out his duties as part of the community and the development of better reasoning in women. However, it can not be concluded that in this case the male decline development but the development of reasoning in men is likely to be slower than in women because the percentage of advanced level in males has a range closer to the percentage of advanced level in women.

This study found also that based on the discussion concerning the interests of public and private interests, female students have better reasoning than boys. It reiterated that social skills and social awareness of women is higher than men. Frequent use of feeling as the basis of the opinion and the compliance rate of women in the existing rules, the causes of which can affect the level of students’ ethical reasoning.

**CONCLUSIONS**

Based on the research findings, the researchers conclude that the development of ethical reasoning in elementary through high school education in general showed a mixed pattern. The ability of students to develop the habit of reasoning diverse causing a decrease in junior high school. This decline is considered as barriers to students in adjusting to the face of the transition from childhood to late adolescence because the reasoning ability of students to increase again when entering the high school level.
Ethical reasoning patterns by gender were obtained on the basis of the statement of boys and girls at every level of education shows that in general girls have the ability to reason ethically preferable in comparison with male students. Dominant female students occupying the advanced level at every level so that it shows that female students are better able to use ethical reasoning as the basis moral problems. Male students are more dominant at the Novice level and the level of socio-emotional because there are differences between male and female. Socioemotional difference is likely to be the cause of the lack of male students in using ethical reasoning when addressing moral issues. Based on the discussion of public interest and any private female students dominate the advanced level than boys that can be caused by the development of social and care of female students.

SUGGESTION

Each carry out a study, researchers will find many limitations and obstacles, especially when taking and processing the data as well as research. The limitations and difficulties that have been experienced is expected to be learning for research activities in the future, so there are some things to consider with regard to research on the development of ethical reasoning as follows. The instrument used in this study is given to students for three different levels so that the use of language and the selection of issues socio-scientific will largely determine the results obtained, the data retrieval should use test descriptions and interviews for all students, for the results obtained actually valid, as well as the use of grouping criteria must absolutely be taken into account. Criteria should be an adaptation of researchers who have to prove that the criterion or criteria have been feasible in judgment by experts.

REFERENCES


Students’ Scientific Reasoning About Global Warming

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Abstract

This descriptive study aims to explore scientific reasoning of junior high school students about global warming. Participants of the study were 32 seventh graders, 32 eighth graders, and 28 ninth graders from multinational school who administered scientific reasoning test and interview. Students were interviewed to explain their reason and evidence which support their arguments in the scientific reasoning test. In addition, students’ questionnaire was also collected and analysed. Scientific reasoning was analysed through students’ arguments. Toulmin Argumentation Pattern (TAP) was used to identify the component of argumentation, which consist of claim, data, warrant, qualifier, and rebuttal. Then, the analysis of students’ arguments involved two aspects: the argumentation components and the strength of argument. The result showed that most students’ arguments (73%) in all grades were consist of claim, data, and warrant only (level 2) without backing, qualifier, and rebuttal to support their claim, and most students’ arguments (47%) in all grades were weak, which means that the ground of argument (data, warrant, backing) were not support their claim. The finding of this indicated that learning activities should provide students with scientific process which emphasis on enganging students to reason because scientific reasoning can be developed through training.

INTRODUCTION

Science teaching is an active process which involves students to think how scientific concepts acquired and applied in the daily life. The NRC (Dolan & Grady, 2010) recommends that students engage in cognitive process that typify scientists’ thinking, such as asking scientifically oriented questions, giving priority to evidence in responding to questions, formulating explanations from evidence, connecting explanations to scientific knowledge, and communicating and justifying explanations. Involvement of students in the cognitive process is very important to train students so they are able to reason scientifically. Zimmerman (Piraksaa, Srisawasdib, & Koulc, 2014) argued that scientific reasoning includes the thinking skills involved in inquiry, experimentation, evidence evaluation, inference, and argumentation. In the science teaching, scientific reasoning is one of important skills because scientific reasoning involved in several processes such as analysing/solving problems, integrating/synthesizing parts, designing/planning explanations, drawing conclusions, generalising, evaluating, and justifying, and applying these capacities to unfamiliar problems (TIMSS, 2007, in Waldrip, 2012).

Students’ scientific reasoning skills can be identified through their output, argument. At the time of reasoning, students produce and evaluate the reasons which would strengthen their argument to convince others. Students also have to reveal strong evidence so their argument can be accepted. Vygotsky (Bekiroglu & Eskin, 2012) revealed that reasoning in children is mainly manifested in their arguing with someone else, and scientific reasoning involves and develops from abilities in argumentation, including...
abilities to identify and evaluate different points of view (Kuhn, 1989, in Bekiroglu & Eskin, 2012). During the discussion, a student may have similar or different explanation with other students. They propose an explanation for each along with the reasons and evidence that they have, so the rationality of science is founded on the ability to construct persuasive and convincing arguments that relate explanatory theories to observational data (Duschl & Osborne, 2002, in Yang & Tsai, 2010).

Argumentation is a form of discourse which includes a reasoning process and promotes critical thinking (Bekiroglu & Eskin, 2012). Science which is characterized by a process of generalization theories/ hypothesis and hypothesis testing through the process of argumentation (Yang & Tsai, 2009). In analyzing students arguments, Toulmin’s Argumentation Pattern (TAP) is still used as a basic reference for many researchers. Toulmin (Bulgren, Ellis, & Marquis, 2014) defined the components of argumentation as reasoning from data to arrive at a claim by using warrants that tie the evidence to the claim, considering additional supports for the warrant, and proposing qualifiers of and rebuttals to the claim.

In the structure of TAP, its components have its function (Inch, Warnick, & Endres, 2006; Simosi, 2003): 1) The claim is presented as the outcome of the argument, it refers to the expressed opinion or conclusion that the arguer wants accepted, 2) the data are arranged on facts or evidences which serves as the basis to support the claim, 3) Warrant expresses the reasoning used to link the data to the claim, 4) Backing composed of facts or reasoning used to support or legitimate the principles contained in the warrant, 5) Qualifier is an adverb that indicates the rational strength the arguer attributes to it, and 6) Rebuttal states the condition that undermine the argument.

Scientific reasoning habits are also important in daily experiences since they provide important ways to make rational and sound judgments about controversial issues in social contexts (Yang and Tsai, 2010). When students deal with controversial issues, students need to make decision on what should they do by revealing evidence and reasons to support their decision. So, when students reason about controversial issues, students can show the reasoning which includes the construction of supporting argument, counter-argument and rebuttal (Sadler & Zeidler, 2004, in Wu and Tsai, 2011). One of issues that can be used to trigger students’ scientific reasoning is global warming. Global warming are widely talked and the effects can influence to all of are in our society, so it need to be instructed in school science (Nuangchalerm & Kwuanthong, 2010). Beside that, teaching science is not only referring to the lesson, but also social interaction in terms of controversial between science and society are stimulated and need to incorporate into school (Nuangchalerm, 2010, in Nuangchalerm & Kwuanthong, 2010).

Based on the research problems outlined above, two research questions guided the design of this research:

1) How is the argumentation components of the 7th, 8th, and 9th graders’ argument?
2) How is the strength of 7th, 8th, and 9th graders’ argument?

**RESEARCH METHODOLOGY**

This research used descriptive method to describe the condition of students' scientific reasoning in natural setting without any treatment. Data were generated through scientific reasoning test, students’ interview, and students’ questionnaire with a total of 72 junior high school students from 7th grade (32 students), 8th grade (32 students), and 9th grade (28 students). Analysis of students scientific reasoning involved two aspects: the component of argumentation and the strength of argument. The students’ arguments were divided into claim, data, warrant, backing, qualifier, and rebuttal based on Toulmin Argumentation

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Pattern (TAP). The component of argumentation was measured by a modified rubric of Dawson & Venville (2009), which classified the students’ ability of argumentation into level 1, level 2, level 3, level 4, and level 5 (Table 1). While the strength of argument was measured by a rubric that developed by researchers, which classified students’ argument into weak, strong enough, and strong (Table 2) based on the validity of the concept, the rationality of statement, as well as the relevance of claim with the grounds (data, warrants, and backings).

**Table 1. Rubric to Measure the Level of Students’ Argumentation Component**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Claim only.</td>
</tr>
<tr>
<td>2</td>
<td>Claim, data, and/or warrant.</td>
</tr>
<tr>
<td>3</td>
<td>Claim, data, warrant, and backing/ qualifier/ rebuttal.</td>
</tr>
<tr>
<td>4</td>
<td>Claim, data, warrant, backing, and qualifier/rebuttal.</td>
</tr>
<tr>
<td>5</td>
<td>Claim, data, warrant, backing, qualifier, and rebuttal.</td>
</tr>
</tbody>
</table>

**Table 2. Rubric to Measure the Strength of Students’ Argument**

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>Claim is logic, supported by true* and relevant grounds (data, warrant, backing).</td>
</tr>
<tr>
<td>Strong enough</td>
<td>• Claim is logic, supported by some true and relevant grounds.</td>
</tr>
<tr>
<td></td>
<td>• Some claims are logic, supported by true and relevant grounds.</td>
</tr>
<tr>
<td></td>
<td>• Some claims are logic, supported by some true and relevant grounds.</td>
</tr>
<tr>
<td>Weak</td>
<td>• Claim is logic, the grounds are true, but the grounds are not relevant with the claim.</td>
</tr>
<tr>
<td></td>
<td>• Claim is logic, but it is supported by false and irrelevant grounds.</td>
</tr>
<tr>
<td></td>
<td>• Claim is not logic, but it is supported by true and relevant grounds.</td>
</tr>
<tr>
<td></td>
<td>• Claim is not logic, supported by false and irrelevant grounds.</td>
</tr>
<tr>
<td></td>
<td>• Claim is not supported by grounds.</td>
</tr>
</tbody>
</table>

*) The term ‘true’ is based on the validity of concepts and the rationality of answer.

**RESULTS AND DISCUSSION**

Students’ scientific reasoning which identified through the arguments were acquired by written test and interview. Interview of students aims to explore the reasons and evidence that used by students to support their argument. A total of 184 students’ arguments (64 arguments from 7th graders, 64 arguments from 8th graders, and 56 arguments from 9th graders) were analyzed based on aspect of argumentation component and the strength of argument. The result of analysis of students’ argumentation component is presented in the Figure 1. Based on the Figure 1 below, most of students’ arguments in all grade were level 2, which means that students only able to generate claim with the data and/or warrant without backing, qualifier, and rebuttal. This result also similar to the result of Dawson and Venville (Dawson & Venville, 2010) and Ekanara (2013), where most of students just generate a claim with data and/or warrant.

Low students’ ability in argumentation can occur because students are rarely involved in the argumentative discussion. As expressed by students, that teachers are rarely give problems/issues for them in learning activity. Teachers are rarely ask for their evidence and reason. In fact, the teacher acts as an initiator in an argumentative discussion through a series of questions (Osborne, 2001), prompting students to generate data,
warrants, backings, qualifier, and also rebuttal. The finding of Bekiroglu and Eskin (2012) also showed that the quantity and quality of students’ arguments increase with their involvement in the argumentation. Thus, the activity which trigger students to produce argument as well as argumentative discussion need to be carried out by teachers so the students are stimulated to be able to reason and generate their arguments. The scarcity of students who involved in argumentative discussion led to students are not able to generate the argumentation components such backing, qualifier, and rebuttal, so none of students’ arguments in the level 4 and level 5 (Figure 1).

Figure 1. Percentage of Students’ Argumentation Component

In the Figure 1 also showed that the ability of students to generate the argumentation component increase only at level 2 due to the higher grade levels. While the level 3 (claim, data, warrant, backing/ qualifier) is more expressed by 7th graders’ arguments than 8th graders or 9th graders. This condition can be caused by students learn global warming concepts in grade 7, so 7th graders were able to generate claim, along with data, warrants, backing/ qualifier compared to 8th graders and 9th graders.

The strength of students’ argument was measured by the criteria of validity of the concept, rationality of answer, and the relevance between claim with the grounds (data, warrants, backing). In the aspect of the strength of argument, most of the students’ arguments about global warming were weak (Figure 2). This showed that there is still many students’ claim which is not equipped with correct and relevant grounds.

Producing valid grounds (data, warrants, and backing) was associated with students’ understanding of scientific concepts. A students, who has a good understanding of the concept, can adduce the evidence or correct scientific data so it can be a relevant basis for his claim. However, the high strength of students’ arguments in the weak category in almost all grade levels showed that there are still many students who have not been able to put forward the valid and rational of scientific concepts. As expressed by Zohar and Nemet (in Foong& Daniel, 2010) that more than 80% of students’ argument contains improper or irrelevant scientific knowledge in the natural classroom setting. Yang and Tsai (in Waldrip et al., 2013) also revealed that students often had difficulty in making and justifying arguments and scientific claims because of their knowledge and their level of cognitive development is not enough.
The number of students’ argument which categorized as weak argument also due to the learning activities do not emphasize students to generate arguments particularly on socioscientific issues. Some researchers (Lemke, 1990, Newton, Driver & Osborne, 1999, dalam McDonald, 2014) revealed that argumentation which rarely effectively incorporated in science classrooms can caused by most classrooms are teacher dominated, with students given few opportunities to learn about, or engage in argumentation, and teachers generally do not possess adequate skills to teach argumentation to their students. This condition cause students are not accustomed to reason and argue with strong evidence and true scientific concepts.

CONCLUSION

Students’ scientific reasoning which identified through the aspect of argumentation component and the strength of arguments in this study indicated that most component of students’ arguments in all grade were level 2, and the strength of students’ arguments were weak. Classroom activities that emphasize on the argumentation and scientific reasoning process should be accustomed, so that students are trained to generate a claim accompanies by true and relevant grounds (data, warrant, and backing), because science education is not only aims to produce students who are competent in the aspect of knowledge, but also competent in some skills that needed in students’ daily life such as argumentation skill which involves reasoning.

REFERENCES


The descriptive study related to the implementation of the environmental project-based learning has been conducted. The purpose of this study is to investigate the level of metacognitive awareness of senior high school students through project-based learning of environmental concept. The subject of study is the first-grade students (N=30) in one of the public senior high school in Bandung. To assess level of student’s metacognitive awareness is used Metacognitive Awareness Inventory (MAI). The results showed that the majority of students have good metacognitive awareness level. The percentage majority of students have good level of knowledge about cognition and regulation of cognition (63.3%). The result also showed that there was very high correlation between student’s knowledge about cognition and regulation of cognition (r=0.881). The averages among indicators of student’s metacognitive awareness, we obtained high correlation, except between declarative and procedural knowledge, which has a low correlation. Based on our study, we found that implementation of environmental project-based learning has facilitated the students to use their metacognitive awareness during the active learning process.

INTRODUCTION

Metacognition is thinking about thinking or thinking about the thinking process itself\(^1\)^. Metacognition related to the monitoring and control of the mind, so that the term refers to a person's ability to consciously plan, monitor and evaluate a learning process. Metacognition is essential to successful learning because it enables individuals to manage their cognitive skills and to determine weaknesses that able corrected by constructing new cognitive skills\(^2\). Students able performed independently and know what they have learned, what being have learned, and what have to learn by their metacognition. One of the core competences on Curriculum 2013 is metacognitive knowledge. This competence is “Students able to understand, implement and explain of factual, conceptual, procedural, and metacognitive knowledge in science, technology, arts, culture, and societies”\(^3\).

Previous researchs, showed that students who have good metacognitive awareness and strategies have better learning outcomes than students who have low metacognitive awareness\(^4\). Metacognitive awareness helps students to plan, select, and monitor their learning process in order to learn, so the impact on learning outcomes will be better\(^5\). These findings suggest that metacognitive awareness has an important role on improving the cognitive achievement of students by increasing the effective use of learning strategies. Metacognitive awareness can help students relate to the concepts of biology and solve a problem based on the concept. Students also needed metacognitive awareness to know what have mastered or not, so they can organize themselves in learning.

Nowadays, the phenomenon of teaching and learning in our school is still “teacher-centered”, so that the student’s involvement in the learning process is not optimum.
Recent research indicates that one model of student-centered learning that more applied is Project Based Learning (PjBL). It provides the opportunity for students to explore a interest concept or topic in depth. Green, stated that students who are involved in PjBL are able to learn better and more active in learning. Thomas also confirmed the positive influence of PjBL to the development of students, including positive attitudes, job skills, awareness of problem solving, and reward students themselves. Several studies in biology education also showed that PjBL has a positive influence on students' science process skills such as observation, prediction, interpretation, asking a question, formulating hypotheses, designing an experiment, gathering and analyzing data. PjBL has various stages that requires student’s metacognitive awareness as learners, such as designing, monitoring, and evaluation, so that student’s awareness needs to be studied.

The concept of environmental is related to student’s daily life. Recent years the environmental problems occur rapidly, such as high level of pollution, global warming and illegal logging. Students who learn of environmental pollution, are expected to realize to conserve the environment and able to design and carry out the ways to prevent and deal with environmental damage.

Many reseachers have studied the implementation of project-based learning in science class, especially in biology. However refers to our best knowledge, there are not enough information about student’s metacognitive awareness during the environmental project learning. This paper describe the level of student’s metacognitive awareness through environmental project-based learning. It is important for students to determine a target that they will accomplish in the future and have control over the learning process.

**RESEARCH METHODOLOGY**

The study is descriptive method. The aim of this study is to investigate level student’s metacognitive awareness of through project-based learning in environmental pollution concept. In addition, correlation test was also conducted to determine the relationship between indicators of knowledge of cognition and regulation of cognition, and the relationship between indicators of metacognitive awareness. This study was conducted on a class, so that the research results only describe the characteristics and ongoing phenomenon.

This study was conducted in first grade students (N=30) at one of the public senior high school in Bandung. Syntax of project-based learning refers to The George Lucas Educational Foundation. Research Subjects were taken by cluster random technique sampling. The instrument is used Metacognitive Awareness Inventory (MAI) is modified from Schraw and Dennison. Inventory questionnaires consist of 52-points, used to measure the knowledge about cognition and regulation of cognition. Knowledge about cognition consists of declarative, procedural, and conditional knowledge, while the regulation of cognition consists of planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation. All statements in this questionnaire are positive statements. This instruments used Likert scale of 1-4 scores, with strongly disagree to strongly agree choose. Data analysis performed by percentage as a whole and on each of the indicators for each level of metacognitive awareness. Correlation test was applied to determine the relationship between knowledge of cognition and regulation of cognition, and the relationship among each indicators of metacognitive awareness.
RESULTS AND DISCUSSION

Environmental project-based learning was carried out on a first grade class (N=30). The projects related to the water pollution problem. Students made some tools for purification of water by chemical and physical ways. The results indicated only three categories of student’s metacognitive awareness levels through environmental project-based learning is excellent, good, and adequate. Figure 1 shows a diagram of the percentage of students' metacognitive awareness levels overall.

Figure 1. Percentage of Student’s Metacognitive Awareness Levels

Based on Figure 1, shows that most students (63.3%) have good level of metacognitive awareness, while 26.7% is adequate, and 10% is excellent. The high score of student’s metacognitive awareness is 92.3, and the lowest is 63. Meanwhile average score of student’s metacognitive awareness is 75.9. According to this result, showed that project based learning has supported the students to learn meaningfully and have managed their own project. They have done the project for sake understanding and regulated of their cognition.

According to the level of student’s metacognitive awareness on each indicator have been measured, the results shown in Figure 2.

Figure 2. Percentage of Student’s Metacognitive Awareness Level on Each Indicator

Indicators description:
1: Declarative Knowledge
2: Procedural knowledge
3: Conditional Knowledge
4: Planning
5: Information Management Strategies
6: Comprehension Monitoring
7: Debugging Strategies
8: Evaluation

Based on Figure 2, shows that the eight indicators indicated most students have good level of metacognitive awareness. Although there are differences among indicators, but only a little compared relatively to other indicators. These results indicated that student’s procedural knowledge more varied than the other indicators of metacognitive awareness, which high percentage on adequate category. Procedural knowledge is the application of knowledge of completing a procedure or process. Procedural knowledge requires students know the process as well as when to apply process in various conditions. Furthermore, procedural knowledge describe the students’ knowledge of regulation of cognition is responsible for the direct or actual activity that occurred during the students learn. When doing the regulation or control of the process of cognition, students apply knowledge of cognition about the task strategies that due to achieve the target or learning goals. Students during doing the project can obtain knowledge through discovery and problem solving about water pollution.

The results also found difference on indicator of debugging strategies. On this indicator, the percentage of the highest metacognitive awareness is excellent (56.7%), in contrast to other indicators, which is the percentage of the highest level of metacognitive awareness is good. Debugging strategies refer to strategies that used to correct comprehension and performance errors. Doing the project are required by students to be able to evaluate and reflect their work.

Comprehension monitoring during project-based learning took place on the stage of students monitor and progress of the project. Comprehension monitoring also performed when students design the project, for example by considering several alternatives in the project before the students solved water pollution problem. With the monitoring, students can find out what are not been mastered, so that he can develop the strategies for improving their knowledge.

Based on correlation test using two types of tests were Pearson correlation test (product moment), and the Spearman correlation test. The indicators were tested and the results of the processing of the data presented in Table 3.

<table>
<thead>
<tr>
<th>No</th>
<th>Variable 1</th>
<th>Variable 2</th>
<th>r</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge of cognition</td>
<td>Regulation of cognition</td>
<td>0.881</td>
<td>Very high</td>
</tr>
<tr>
<td>2</td>
<td>Declarative knowledge</td>
<td>Procedural knowledge</td>
<td>0.369</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Procedural knowledge</td>
<td>Conditional knowledge</td>
<td>0.701</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Planning</td>
<td>Evaluation</td>
<td>0.619</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Information Management strategies</td>
<td>Comprehension Monitoring</td>
<td>0.673</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Comprehension Monitoring</td>
<td>Debugging strategies</td>
<td>0.636</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Comprehension Monitoring</td>
<td>Evaluation</td>
<td>0.775</td>
<td>High</td>
</tr>
</tbody>
</table>
Based on Table 3, shows that seven correlations are positive values and the averages are 0.600 to 0.800. Unlike the indicator with procedural and declarative knowledge, where both indicators have a relationship which is in the low category with a correlation coefficient of $r = 0.369$. This can be related to the percentage value on procedural knowledge tends to be different to the value of the other indicators. Correlational results between knowledge of cognition and regulation of cognition in project-based learning to obtain positive results value of $r$ and are at very high category. According to the assumptions of theories about metacognition that knowledge of cognition and regulation of cognition interconnected $^3, ^{10}$.

**CONCLUSIONS**

The level of most student’s metacognitive awareness through environmental project-based learning have good level. Similarly, the level of metacognitive awareness in each indicator, showed that the majority percentages are good categories. Student’s knowledge about cognition and regulation of cognition have a close relationship, with the correlation coefficient average is high. That is, students who have good knowledge about cognition in project-based learning are likely to have good regulation of cognition as well. Implementation of environmental project-based learning has facilitated the students to use their metacognitive awareness during the active learning process.

**REFERENCES**


The Profile of Biology Education Students, Universitas Terbuka, on Self Regulated Learning

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²Departemen Pendidikan Biologi, Universitas Terbuka Indonesia, Jl. Cabe Raya, Pondok Cabe, Tangerang Selatan 15417, Indonesia

Abstract

Universitas Terbuka (UT) is the one of distance education institutions in Indonesia. The one of characteristics of distance education is that the students are separated physically from the teacher or tutors. It seems that in distance education environment, learners do not supervised regularly in regular bases. Therefore, distance learners are demanded to have high self regulated learning. This paper discusses about the study on profile of Biology education students’ of Indonesia, Universitas Terbuka on self regulated learning. The purpose of the study is to determine the profile of UT biology education student’s self regulated learning. The method used in the study is survey. The questionnaires are collected from 102 students where located in 10 regional offices. The results showed that self regulated learning of biology education students is at about middle level, especially the level for indicators of strategic planning, self controlling on strategic planning, metacognition, self observation on learning process, self evaluation, intrinsic interest and self efficacy are need more attention. In conclusion, it might need to do further study to enhance self regulated learning especially in the aspects of strategic planning, self controlling on strategic planning, metacognition, self observation on learning process, self evaluation, intrinsic interest and self efficacy.

INTRODUCTION

One of characteristics of distance education is physically separation among students and teacher (Moore & Kearsley, 2012; Simonson, et.al, 2012). There is a limited opportunity for instructor and students to interact. Therefore, it needs technology to facilitate interaction among them and requires students who have ability to study independently. The students need to decide on their own how to self regulate their learning. To achieve students’ success in distance education, students are demanded to have high students’ self regulated learning. It means that students have to maintain their learning motivation, control their time and learning strategy or have initiative to study. Moreover, Wedemeyer (Simonson, et al. 2012) stated that the essence of distance education is student’ self regulated learning.

At distance education, self regulated learning is one of factors that influence students’ achievement (Darmayanti, 2005). This corresponds to the result study conducted by Tahar & Enceng (2006) that there is a positive relationship between students’ self regulated learning and students’ achievement. Furthermore, Daryono (2013) stated that factors affecting student attrition in distance education, in the case of Universitas Terbuka (UT), are that students have a lack of self regulated learning (33%) dan motivation (7%).
Ideally, students of distance education have high self-regulated learning since its learning environments demands high students’ self-regulated learning. However, according to some studies, UT’s students have a variation in the degree of readiness to self-regulated learning. It categorized average tends to low level at students of Public administration (Darmayanti, 1993), above average level at students of Business administration (Tahar & Enceng, 2006) and high level at bidik misi students (Hendrayana, Thaib & Rosenenti, 2014). Unfortunately, there have not been conducted study to measure the readiness of self-regulated learning for biology education students. Therefore, this paper will discuss about self-regulated learning of biology education students, Universitas Terbuka.

Self Regulated Learning

Zimmerman & Schunk (2001) determine self regulated learning as a process involving students’ effort in managing and regulating complex learning activities to achieve academic goal. According to Zimmerman (1998), self regulated learning refers to the degree to which students actively use their metacognitive skills, motivational, and/or behavioral strategies in their learning process to attain their academic goals. In this situation, student act as an proactive participant and have responsibility to his learning process. In other words, self regulated learning refers to the degree of students’ metacognitive, motivation and behavior. Pintrich (2000) stated that self regulated learning is an active and constructive process in which a student determines their own goal learning and then monitors, regulates, controls his cognition, motivation and behavior to achieve his goal. Based on the experts’ statement in the above, self regulated learning is an active process of students in managing the learning process at the initiative of the students themselves in setting learning goals, monitor, control, and evaluate cognition, motivation and behavior to achieve learning objectives.

Self regulated learning is a cyclical process that influenced by factors of person, behavior and environment. (Zimmerman, 2005). Such adjustments are necessary because personal, behavioral and environmental factors are changing during learning and performance and must be observed or monitored. In other words, self regulatory process of a student is influenced not only by himself or his behavior but also greatly affected by his environment.

For example, a student ability to regulate his learning is not only influenced by his interest to accomplish a task but it is also affected by the environment that supported him, such as the help he gets from the instructor or peers.

According to Schunk and Ertmer (2005), self regulated learning refers to self thoughts, feelings and action that are planned and systematically adapted as needed to affect one’s learning and motivation. Self regulated learning comprises of learning process conducted by students such as setting goal for learning, attending and concentrating on instruction, use effective strategy to organize, code and rehearsal information to remember, establishing a productive work environment, using resource effectively, monitoring performance, managing time effectively, seeking assistance when needed, holding positive beliefs about one’s capabilities, the value of learning, the factors influencing learning, anticipated outcomes of action, and experiencing pride and satisfaction with one’s efforts.

Based on social cognitive perspective, self regulatory as a cyclical process consists of three phase, namely forethought phase (before learning), performance or volitional control phase (during learning), and self reflection phase (after learning) (Zimmerman, 2000). The figure of phase and process of self regulated learning can be seen below.
Forethought phase focuses on students’ action and belief that influence their learning preparation. This phase consists of task analysis and self motivation. Task Analysis consists of goal setting and learning strategies. Goal setting is an activity to set and to modify learning objective. A student who sets his learning objectives by himself, he’ll get achievement better than who does not. To achieve his objective, a student should determine appropriate learning strategies. Planning strategy is strategy that is used to achieve the objective. A student is able to modify learning objective after monitoring learning achievement. During performance or volitional phase, student uses strategy to self control. This strategy includes self instruction, imagery, focusing attention, and strategy to achieve goals. Student involves self observation through self monitoring. Self monitoring technique includes diary note, or visual such as graphics. Third phase is self reflection. At this phase, student does self judgment and self evaluation. (Zimmerman, 2008).

Each student has different level of self regulated learning. It depends on his learning motivation, his learning strategy, his learning methods, how he use of learning environment and social. Student who has low self regulated learning level tends to low achievement at school. The lowness of self regulated learning is caused by ineffectiveness technique that used at forethought phase and work control. Ineffectiveness can be caused by unstructured of goal setting, strategic planning and development performance. (Zimmerman, 2000).

Furthermore, Zimmerman (2000) stated that other things that can influence student self regulated learning are: 1) lack of social learning experience. The one who reared at family environment that did not teach self regulated learning, he would get difficulty in doing self regulated learning; 2) lack motivation or apathy or disinterest; 3) mood disability, such as mania or depression; unhealthy; and 4) learning disabilities.

**Universitas Terbuka as a Distance Education Institution**

Distance education is a teaching and planned learning in which students and teachers are in a different place and sometimes in different time, so it requires a special institutional organization as well as communication through technology (Moore & Kearsley, 2012). Communication or interaction among students and instructors at Distance
education can be facilitated by printed material, electronic technology or informatics technology. Universitas Terbuka (UT) is one of distance education institutions in Indonesia. In general, UT is intended to provide a wider access to higher education for high school graduates and practicing teachers who cannot attend conventional universities for various reasons, including demography, economic, geographic or time factors (Belawati, 2000; Zuhairi & Budiman, 2009).

The main learning material of UT is often called by module. The characteristics of module are self content dan self instruction. It means that module is designed containing concepts and instruction so that it can be learnt independently by the students. Beside module, there are other supplement or supported learning materials in a form of non printed materials such as audio CD, audiographyc CD, video CD, interactive video CD, computer assisted instruction (CAI) and other online based enriched materials.

UT provides some learning support services such as face to face tutorial, tutorial online, tutorial through radio and television. Face to face and online tutorials deliver intensively, eight times per semester for each course. A tutor guides and leads a discussion at the learning process. Biology Education is one of study program at Faculty of Teacher Training and Educational Sciences. Its students are teachers of Senior or Junior High School who wants to continue study without left their duty.

RESEARCH METHODOLOGY

This study is a preliminary study. The method used in the study is survey. The questionnaires were collected from 102 students of Biology education- UT where located in 10 regional offices, those are, UPBJJ-UT Bandung, Jakarta, Serang, Surakarta, Surabaya, Bogor, Palembang, Medan, Palangkaraya, and Ternate. The students who fulfilled the questioners are students who take the second exam day of UT. Most of them are the first to eight semester students. The questionnaires consisted of 32 items with four options, those are, always, often, rarely, and never.

RESULTS AND DISCUSSION

1. The Scale of students’ self regulated learning

The average score of students’ self regulated learning is at middle level that is 80.62 (62.98%). Maximum score of self regulated learning that should be achieved by student is 128. The range score achieved by students is 50 (39.06 %) to 102 (79.69%) with deviation standard is 10.96. Of 102 students who fulfilled the questioner, 65% the score of self regulated learning is at the range 61 to 80, 33% is at the range 41 to 60 dan 2 % is at the range 21 to 40. Figure 1 illustrates the degree of students’ self regulated learning.

![Figure 1. The degree of students’ self regulated learning](image-url)
Referring to this table, we can see that the most student (71%) has score of students’ self regulated learning at the middle level. Only 29% of students have the degree of self regulated learning at the high level. However, the middle level of self regulated learning is not enough for distance education students, since the essence of distance education is student’ self regulated learning (Wedemeyer in Simonson, 2012). Distance education students are demanded to have high skill in self regulated learning. Therefore, this skill needs to be improved. Furthermore, the average score achieved by students for each aspect can be seen in Table 1.

### TABLE 1. the average score each indicator of students’ self regulated learning

<table>
<thead>
<tr>
<th>No</th>
<th>The aspects of self regulated learning</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(in 4 scale)</td>
<td>(in %)</td>
</tr>
<tr>
<td>1</td>
<td>Goal setting</td>
<td>3.2</td>
</tr>
<tr>
<td>2</td>
<td>Strategic planning</td>
<td>2.0</td>
</tr>
<tr>
<td>3</td>
<td>Self efficacy</td>
<td>2.5</td>
</tr>
<tr>
<td>4</td>
<td>Goal orientation</td>
<td>3.6</td>
</tr>
<tr>
<td>5</td>
<td>Intrinsic interest</td>
<td>2.5</td>
</tr>
<tr>
<td>6</td>
<td>Self control</td>
<td>2.1</td>
</tr>
<tr>
<td>7</td>
<td>Metacognition</td>
<td>2.2</td>
</tr>
<tr>
<td>8</td>
<td>Self observation</td>
<td>2.3</td>
</tr>
<tr>
<td>9</td>
<td>Self evaluation</td>
<td>2.6</td>
</tr>
<tr>
<td>10</td>
<td>Motivation</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>The average</td>
<td>2</td>
</tr>
</tbody>
</table>

Comparing to the other aspects of students’ self regulated learning, the aspect of goal setting dan goal orientation have the highest of average score, that is, 80 % and 90.3%. However, the aspect of strategic planning, self control, metacognition dan self observation have the average score of students’ self regulated learning at below 60% and the aspect of intrinsic interest, self efficacy, self evaluation and motivation are in between 60 to 70%. (see Table 2)

The aspect of goal setting and goal orientation get the high score might be caused the most students of Biology education are teachers of junior and senior high school. They study at UT since they really want to improve their qualification (to be a sarjana). It relates to the score of aspect of motivation that they achieved, is about 69%. It means that they also have enough motivation to study. However, they do not have the capacity to regulate their learning. They might not have the strategy to achieve the academic goal and to maintain his learning control. It can be seen from the average scores of strategic planning, self control, metacognition and self observation of students are under 60%. Strategic planning is a skill that supposed to be conducted at forethought phase, before starting study. This skill seems not to be owned optimally by the students of Biology education. To improve this skill or attitude, a teacher or tutor can suggests or remains his students in order to change their learning strategy. (Zimmerman, Bonner & Kovach, 1996).

The aspect of self control, self observation and metacognition are the aspects of self regulated learning at volitional phase. These skills have not been owned by students optimally, though the most intakes of biology educations students are from D3 (Sekarwinahyu, 2015). It corresponds to the result study conducted by Kristanti and Islam (2003), that there is no different significantly, the level of self regulated learning among UT students who graduated from SMA, D1, D2, D3 or S1.
The students that domicile at 10 of 39 regional offices fulfilled the questioner. The number of students per each regional offices who fulfilled the questioners is variation. Based on the average score of students self regulated learning, the level of students’ self regulated learning each regional offices is not significantly different. Students of UPBJJ-UT Surabaya has the highest score of students’ self regulated learning, that is 65.55%. It is followed by the students of UPBJJ-UT Surakarta (65.5%), Bandung 63.2%, Palembang 62.5%, Medan 61.9%, Ternate 61.7%, Jakarta 61.6%, Bogor 61.1%, and the lowest is Palangkaraya 51.3%. (see Figure 2).

**FIGURE 1.** the average score of students’ SRL per regional offices

**CONCLUSIONS**

Most self regulated learning of biology education students of Universitas Terbuka is at about middle, however, there are some aspects that have to be improved, such as strategic planning, self controlling on strategic planning, metacognition, self observation on learning process, self evaluation, intrinsic interest and self efficacy. Therefore, we’ll continue to study on how to improve this skill so can improve students’ achievement and students’ commitment to accomplish their study.

**ACKNOWLEDGMENTS**

We thank to head of UPBJJ-UT Surabaya, Surakarta, Bandung, Palembang, Medan, Ternate, Jakarta, Serang, Bogor and Palangkaraya who helped us to distribute the questioners to the students.

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Improving Student Teachers’ Higher Order Thinking Skills in Cell Biology

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Article info

Keywords:

A study using Research and Development method was focused on facilitating higher order thinking skills for prospective biology teachers. It was carried out to develop students’ reasoning and analytical thinking in Cell Biology. Integration of Formative Assessment Attributes in Cell Biology learning (IFAA-CB) program was applied in learning process. A number of 3rd semester Biology Education in Semarang State University in 2012-2013 (n=61) was involved as research subject. The study was consists of two phases. Program development phase was held in 2012 (n=29), and program implementation phase in 2013 (n=32). Development of students’ reasoning and analytical thinking was measured using validated instrument, among others were concept map, articles review, and 30 selected response questions. The results showed that students’ reasoning and analytical thinking skills in Cell Biology can be improved significantly. However, the findings suggested that argumentation ability in students’ analytical thinking skills still needs serious improvement. The other findings described that there was no difference among male and female students in reasoning and analytical thinking skills improvement.

INTRODUCTION

Some research result (Coletta et al., 2007¹; Reynolds & Moskovitz, 2008²; Fencl, 2010³; Noblitt et al., 2010⁴; Reynolds et al., 2012⁵) describes that the implementation of science learning process tendsynonymous with material information in wide coverage. Although aspects of mastery of the material and breadth of coverage required in learning science to understand the daily life phenomena, but these conditions are not enough to ensure that learners can understand all material being studied. One indicator of students’ understanding of science material is thinking skills ability, such as skills to explain, collect evidence, provide an example, formulate generalizations, applying concepts, making an analogy, usingreasoning, as well as presenting scientific concepts in new situations (Janssen et al., 2009⁶; Fry et al., 2009⁷).

Certainly, the qualification standard of college graduates is not just mastery required extensive content. The ability and skills to think and act are main factors that determine. Therefore, learning in college should take notice and implement schemes of higher order learning scheme (Fry et al., 2009). Scheme of higher order learning emphasizes on understanding and creativity of students, such as being able to understand and re-construct knowledge based on facts, analyze the relationship between knowledge with other relevant knowledge, as well as being able to develop critical thinking and creativity.

Characteristical subject matter of Cell Biology has a very important role in development of understanding, reasoning ability, concepts application, analytical thinking, as well as provide insight to students about the phenomenon of life. Some factors have
been identified to be the cause of students disadvantage develop their reasoning and analytical skills in learning Biology Cell. The research results showed that teachers tended to develop by providing learning materials as much as possible, in hopes students will be able to understand and apply knowledge acquired (Smith et al., 2008; Gotwals & Songer, 2009).

This study developed Integration of Formative Assessment Attributes program in Cell Biology course (IFAA-CB) to help students understand essential concepts and metabolic processes, furthermore to develop reasoning skills and analytical thinking. Formative assessment is an assessment process carried out during learning as feedback to understand student learning progress (Black & William, 1998; Tanner & Allen, 2004; Furtak & Primo, 2008).

This study provides an overview of IFAA-CB program implementation to facilitate students’ reasoning and analytical thinking skills development in Cell Biology. Specifically, this study to answer the following questions:
1) How does students’ reasoning and analytical thinking in Cell Biology before and after IFAA-CB program implementation?
2) How does students’ reasoning and analytical thinking in Cell Biology after IFAA-CB and direct learning program implementation?
3) How does students’ reasoning and analytical thinking based on gender difference?

RESEARCH METHODOLOGY

Subject
Subject in this study was students of Biology Education Department, Semarang State University who are taking Cell Biology courses. Number of subject was 61 students who are divided into two groups, 29 students as experimental group-1 (Direct Instruction program) and 32 students as experimental group-2 (IFAA-CB program).

Design
Design of study is a Research and Development. Figure 1 shows this research design. The significance of reasoning and analytical thinking skills would be examined as two group pretest-posttest design. Scheme of research design was described as follow.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment-1</td>
<td>(O_1)</td>
<td>(E_1)</td>
<td>(O_2)</td>
</tr>
<tr>
<td>Experiment-2</td>
<td>(O_3)</td>
<td>(E_2)</td>
<td>(O_4)</td>
</tr>
</tbody>
</table>

\(E_1\): Direct Instruction
\(E_2\): IFAA-CB

**FIGURE 1.** Research design

IFAA-CB Program
IFAA-CB program in Cell Biology course covers inductive thinking activities through information, discussion, and posing questions and answers. In IFAA-CB program included individual and group assignments. Individual tasks include students’ ability of reasoning and analytical thinking in Cell Biology. Group tasks include concept maps and
Proceeding International Seminar on Mathematics, Science, and Computer Science Education

report of research article review. Learning process was implemented classically. During learning process, twice of quizzes would be administered to detect student's learning progression. Figure 2 describes IFAA-CB program in Cell Biology learning process.

Characteristics of IFAA-CB program are (i) formative assessment attributes were integrated during learning process is ongoing. It is learning goals, collaboration, self- and peer -assessment, learning progression, and feedback; (ii) learning strategy consists of six stages in cycles, goals identification, phenomena interpretation, concepts findings, concepts organization, concept relevance, and learning review.

FIGURE 2. IFAA-CB program in Cell Biology course

Validity of IFAA-CB Program

IFAA-CB program validity should be proved on two criteria, program feasibility and significance in developing students’ reasoning and analytical thinking. IFAA-CB feasibility test focused on each stage of learning syntax. The significance test of IFAA-CB program focused on meaningfully of students’ reasoning and analytical thinking skills in Cell Biology during learning process.

Data Analysis

Data analysis of students’ reasoning skills and analytical thinking development in Cell Biology would be done quantitatively. To measure signification of difference N-gain and pretest-posttest mean of final result test of two groups experiment, t-test (SPSS 20) technique was applied.

RESULTS AND DISCUSSION

Implementasi Program IAAF

The results of IFAA-CB program implementation shows that learning process of six stages and formative assessment attributes were integrated in learning process was meaningful to develop students’ reasoning and analytical thinking skills. Development of these skills was identified through individual and group tasks results.

Students’ Reasoning and Analytical Thinking AbilityBefore and After Class

Students’ reasoning and analytical thinking in Cell Biology was measured using 30 items written test. Figure 3 shows the results of pretest and posttest score after test.
FIGURE 3. Score of students’ reasoning and analytical thinking skills in Cell Biology

Posttest measurement results on all categories have increased. The results indicate that correlation reasoning, probability reasoning, and proportional reasoning growth in good categories. Likewise, the ability of analytical thinking in identifying main ideas and comparative experience develop in good categories. However, development of students’ argumentation ability was shown in medium category.

Significance Test of IFAA-CB Program

IFAA-CB program significance was measured by comparing mean scores of pretest, posttest, and N -gain between students’ reasoning and analytical thinking in Direct Instruction program (Group-1) and IFAA-CB program (Group-2). Table 1 shows the results.

<table>
<thead>
<tr>
<th>Table 1. Result of pretest, posttest, dan N-gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pretest</td>
</tr>
<tr>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
</tr>
<tr>
<td>Posttest</td>
</tr>
<tr>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
</tr>
<tr>
<td>N-gain</td>
</tr>
<tr>
<td>E1</td>
</tr>
<tr>
<td>E2</td>
</tr>
</tbody>
</table>

* α = 0.05
E1 : Group direct instruction
E2 : Group IFAA-CB

Results in Table 1 show that Cell Biology learning outcomes through IFAA-CB and direct instruction program differed significantly. N-gain of both groups also showed significantly different results.

<table>
<thead>
<tr>
<th>Table 2. Results of reasoning and analytical thinking skills posttest scores in Cell Biology based on gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Pretest</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Posttest</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
</tbody>
</table>

* α = 0.05

The average score reasoning abilities of female is higher than male. Nevertheless, statistically the reasoning ability scores in Cell Biology at pretest and posttest for both
Characteristics IFAA-CB learning program provides opportunities for faculty and students to collaborate in achievement of learning objectives. IFAA-CB program gives students opportunity to develop higher order thinking skills. Implementation of IFAA-CB program has a positive effect on the development of students’ reasoning skills in Cell Biology, especially in correlation, probability, and proportional reasoning. IFAA-CB program also gave positive influence to develop students’ analytical thinking, especially in identify the main ideas, argumentation, and comparative.

IFAA-CB programs pay attention the results of research related to Cell Biology course at college. Results of a study conducted by Quitadamo & Kurtz (2007), Gotwals & Songer (2009), and Fencl (2010) recommends that to understand cellular life phenomena through Cell Biology course is not only necessary memory capabilities, but also takes a high-level thinking skills. Reasoning and analytical thinking is a high level of cognitive ability that can be trained through relevant learning programs.

Assessment was applied in IFAA-CB program gave positive effect in development of students’ reasoning and analytical thinking. Giving the relevance task, either individually or in groups, as same as giving opportunities for students to explore using reasoning and analytical thinking in completing the task. Provision of individual and group assignments can be influence on student motivation in learning (Ueckert et al. 2008; Hurney, 2012; Linton et al. 2014). Work assignments individually give students opportunity to develop their abilities based on their own opinion, while the task group can motivate students to develop their ability based on their opinions and interact with friends in the group.

Concept mapping have a positive effect in reasoning ability (Odom & Kelly, 2001; Lawson et al., 2007; Bao et al., 2009). By concepts identifying and then give meaning the relationship between concepts identified, students have been using reasoning abilities. Students’ thinking skills must be trained gradually and simultaneously so that they have habits of mind and being able to take a decision based on reasoning skills. Novak & Canas (2008) gave recommendation that a concept map is a visual representation that includes relationship between concepts and explanations of word or phrase about phenomena. The preparation of a concept map requires ability to think critically, because ability to interpret the concept maps can be defined that students have made meaningful learning process, and not just rote learning.

Giving students the opportunity to review of research article is one way to practice writing and communicating. The forms of assignment to support assessment implementation, such as writing, reviewing and communicating were effective in improving student learning progress (Quitadamo & Kurtz, 2007; Noblitt et al., 2010). Analytical thinking skills can also be developed through relevant article review. Understanding an article, and then provide review to article and then presented the results requires the ability to think critically and develop critical thinking (Quitadamo & Kurtz , 2007; Reynolds & Moskovitz, 2008; Noblitt et al., 2010)

The results were shown in Table 1 and 2 indicate that implementation of IFAA-CB program provides significant influence on students’ development of reasoning skills and analytical thinking. Giving students the opportunities to think and analyze learning process of Cell Biology have a positive influence on understanding of subject matter. Nonetheless, based on descriptive analysis in this study found that students ability of the argumentation (one type of analytical thinking skills) still get a low score. Of course, it is to be a serious
note for lecturer when applying IFAA-CB program.

Jimenez-Aleixandre & Erduran21 (2008) were stated that the ability to argue in science is not easily owned skill. There are three important things in argumentation in science, we must understand of scientific concepts, scientific concepts linkages with social problems, and high-level thinking skills. Therefore, development of science argumentation required investigation and exploration activities are drilled repeatedly. Dauer et al.22 (2014) were stated also that in order to be able to argue well needed high-level thinking skills. One strategy that can be applied to train argumentation ability is the application of assessment by scaffolding gradually adjusted to the level of difficulty and relevance.

CONCLUSION

Higher order thinking skills, particularly the ability of reasoning and analytical thinking can be developed through implementation IFAA-CB program of Cell Biology course. One of the characteristics of the IFAA-CB program is formative assessment attributes were integrate in learning process, giving students opportunity to develop higher level thinking skills through the completion of the relevant task. Nevertheless, the application of the IFAA-CB program does not guarantee the development of the argumentation ability in Cell Biology well. Implication of this research is Cell Biology faculty should include higher thinking skills in a lecture.

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An Analysis On The Capabilities Of Pre-Service Biology Teachers In Preparing A Lesson Plan For The Course Of Teaching And Learning Strategies

Eka Ariyati

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Abstract

This research aimed to find out the capability of the pre-service biology teachers in preparing lesson plans through assignments and feedback in the course of teaching and learning strategies. The quasi-experimental method was used with the one group pretest-posttest design. The samples in this research were 27 fourth semester students of biology education department who were taking a course of Teaching and Learning Strategies. Samples/students were assigned to prepare lesson plans through regular lectures, while the feedback was given based on the findings of the lesson plans designed and a review of relevant theories. The data were collected using a performance rubric and field notes. The data were then analyzed using the mean-difference test and normalized gains. The results of the study revealed that there was an increase in students’ capability to prepare lesson plans. In preparing the lesson plan, students pay little attention to the compatibility of the content of biology learning material with the learning objectives, and tend to ignore the steps of the learning model used. This study concluded that the capability of pre-service biology teachers to prepare lesson plans improved through the activities offered in the Teaching and Learning Strategies. The assignments and feedback given had an influence on/contribution to the activity.

INTRODUCTION

By virtue of the Government Regulation No. 19/2005 regarding to the standard process, teachers are expected to be able to develop lesson plans. It was reinforced by the Regulation of the Minister of National Education Number 41/2007 on the Standard Process, which among others regulates the planning of the learning process which requires the educators in an educational unit to develop a lesson plan (RPP), particularly at the level of elementary and secondary formal education.

Basically, when an activity is planned in advance, the goals will be clear and success will be imminent. Therefore, a teacher should have the capability to plan instructional activities. In designing lesson plans, teachers should obviously consider the implementation of learning activities in the classroom which include setting the indicators, defining learning objectives, determining strategies that will be used in teaching such as the use of methods or models, or formulation of evaluation instruments.

The competence of student teachers in preparing lesson plans is still unsatisfactory. The findings of the implementation of microteaching showed that most students still had difficulty in explaining the teaching materials according to the objectives and in preparing their lessons. These findings revealed that what they learnt from the course of Teaching and Learning Strategies was not sufficient and thus they needed improvements related to the syllabus and learning activities.
In the course of Teaching and Learning Strategies, students should have learnt various learning strategies that include models, methods, approaches, techniques, and instructional media, as well as teaching materials and learning resources. By mastering these concepts, students will be able to organize a teaching process through preparing lesson plans. To organizing here means to unite or arrange parts in order to achieve specific objectives (Depdikbud/Department of Education and Culture, 1994). Therefore, the preparation of lesson plans, in this case, should utilize the model/method/approach/techniques of instruction and choose the right media that fit the material presented as well as the learning objectives.

Providing the necessary skills for student teachers to prepare a lesson plan is not easy. In this study, student teachers were given assignments that would later be asked for feedback or assessment. The assignment began with determining learning objectives, selecting and organizing teaching materials, selecting instructional strategies and resources as well as learning media, compiling learning scenarios, and planning evaluation. However, the planning evaluation was not the focus of this activity as the student teachers had not received a course of evaluation and learning outcomes.

Based on the research background, the researchers are interested in investigating the capability of Biology student teachers in the preparing lesson plans through the provision of assignments and feedback as a means of being a professional teacher.

RESEARCH METHODOLOGY

This study used the quasi-experimental method with one group pretest-posttest design (Fraenkel & Wallen, 2006). The design used can be seen in Table 1.

<table>
<thead>
<tr>
<th>Pretest</th>
<th>Treatment</th>
<th>Posttest</th>
</tr>
</thead>
<tbody>
<tr>
<td>O₁</td>
<td>X</td>
<td>O₂</td>
</tr>
</tbody>
</table>

O₁ (pretest), is the preliminary condition of students with some understanding of lesson plans; O₂ (posttest), the final condition of students with some understanding of lesson plans after treatment; X, the treatment in the form of lesson plan preparation through regular lectures with assignments and feedback.

The samples were 27 fourth semester students who took a course of Teaching and Learning Strategies at the Biology Education Department of the Faculty of Teacher Training and Education (FKIP) Tanjungpura University in the academic year 2014/2015. The samples prepared lesson plans through regular lectures with assignments. The lesson plans made were then followed up with feedback based on the study findings and relevant theories.

The instruments used in this research were performance rubrics and field notes. Performance rubrics were used to identify the capability of pre-service teachers in preparing lesson plans for the biology subject in junior high or senior high schools. Meanwhile the field notes were used to record the events that occurred during the samples’ preparation of lesson plans. The data obtained from the rubrics of performance were analyzed using the test of mean-difference and normalized gains, while the data of field notes were analyzed descriptively since the findings will be used in the discussion and conclusion. The samples were 27 fourth semester students who took a course of Teaching and Learning Strategies at the Biology Education Department of the Faculty of Teacher Training and Education (FKIP) Tanjungpura University in the academic year 2014/2015. The samples prepared lesson plans through regular lectures with assignments. The lesson
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RESULTS AND DISCUSSION

The capability of student teachers in preparing lesson plans is shown in the results of the mean score before and after the activities. The results of initial and final mean score, and N-gain are shown in Figure 1.

![Figure 1. Initial and final mean score, and N-gain of Lesson Plan Preparation](image)

Figure 1 shows an increased capability of student teachers in preparing lesson plans through the assignments and feedback in the Teaching and Learning Strategies course. The mean score of 6.79 before treatment increased to 9.62 after treatment with the percentage of N-gain of 0.53 which was categorized as having a median increase.

The student teachers were also provided with general material about lesson plans and components that had to be met then asked to select the basic competencies that they were interested in. After choosing the basic competencies of their interest, they were assigned to prepare lesson plans by utilizing their knowledge and skills and using available references. This is in accordance with the view of constructivism, in which the learning process aims to construct understanding rather than simply collecting as much knowledge as possible without understanding. Bruner (in Baharudin and Wahyuni, 2007) argued that the individual must actively "build" their knowledge and skills.

The reviewed lesson plans indicated that the students had not been able to prepare learning objectives appropriately. Complete formulation of objectives should cover at least the components of learners (can be implied), learning outcome behavior (in the form of operational verbs), and should also contain essential material (Anggraeni, 2009). The formulation of the learning objectives made was not in accordance with the basic
competencies, where the goal should have been adapted from the basic competencies and indicators as well as the accuracy of choosing the operational and essential material.

The students / pre-service teachers might have not regarded the formulation of learning objectives as important in lesson plan. In fact the development of a lesson plan should begin with formulating the learning objectives. According to Trowbridge et al (1973) determining good learning objectives is very important because without these objectives, the focus of learning will be unclear, confusing and frustrating for teachers and ineffective for students. Uno (1999) argued that when a teacher designs a lesson plan, there are several questions that need to be answered regarding the learning goals, i.e. what should be known, addressed, and done (performance) by the students, under what conditions students can demonstrate these capabilities, how students will be able to achieve the criteria set by the teacher.

Poorly-designed learning objectives may affect the students' capability in compiling teaching materials because the teaching materials should refer to the previously defined learning objectives. According to Abdul (2008), teaching materials are the information, tools, and texts which require teachers to plan and review the implementation of learning. Meanwhile, in selecting a strategy, all students used learning models but incompatibility between the material chosen and the learning scenario they had set was still found. According Samani et al (2006) a learning scenario demonstrates how learning steps should be performed i.e. the opening stage, the core activities and the closing. These stages should be reflected in the strategy / models and methods used including the allocation of time at every stage. Most of the students already had a learning scenario that consisted of the opening, the core and the closing but it was still not appropriate yet. With regard to the selection of learning resources and media, it was generally excellent even though there were students who relied solely on the LCD projector as the medium. They were also less creative in terms of creating or modifying instructional media.

After obtaining the initial data as described above, the researchers prepared the treatment. It began by selecting 2 student teachers who were doing microteaching to become mock students, where they had to listen to the presentation from their peers and provided comments about the lesson plans presented. Then each student was given the assignment to prepare a lesson plan by first describing the basic competencies to formulate as the indicators and learning objectives, and determining the appropriate basic material. Then they continued with selecting strategies, learning resources and instructional media accordingly. In addition, they also arranged the learning scenario. Finally, students should simulate a lesson plan in the form peer teaching. With the peer teaching activity, the students’ knowledge and skills in preparing lesson plans were clearly visible. Each completed activity was directly given feedback for improvement.

After the treatment, the formulation of learning objectives made by the student was better than before, despite the fact that 2 students did not use the operational verbs and 1 student who set objectives that was incompatible with the basic competencies and indicators. In addition, it was found that students paid less attention to the suitability of the content of biology material with learning objectives and tended to ignore the phases of the learning model used.

The results of statistical analysis indicated that there was a significant increase in the capability in the preparing lesson plans before and after treatment. It was possible because the students followed each step for preparing the lesson plan and received direct feedback during the process. The process proved to be able to provide reinforcement to students with regard to improving their knowledge and skills in preparing lesson plans.
CONCLUSIONS

The student teachers’ capability in preparing lesson plans increased through assignments and feedback in the course of Teaching and Learning Strategies. This study suggested that students need instruction and guidance from lecturers so as to effectively train them to prepare the biology lesson plan. Pre-service biology teachers need a lot of practice and examples for preparing and implementing the learning process so that they will have a lot of experience in designing biology lesson plans.

ACKNOWLEDGMENTS

We would like to express our gratitude to the Biology Education Department of the Faculty of Teacher Training and Education (FKIP) Tanjungpura University for all the facilities made available during this research.

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BIO-05304

Students’ Misconceptions of Arthropods Using Three Tier Test

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Article info

Keywords:

Abstract

Arthropods is one of the topics learns in senior high school (SHS). This research aims to identify the SHS students’ misconceptions of arthropods by using the three tier test. This topic was chosen because the animals that classified into the phylum Arthropoda was the most commonly found in the students daily life. Knowing the common misconceptions of this topic is important to prevent another misconceptions of the other related topics. Descriptive research was conducted in three public schools in Bandung, by involving 96 grade 10 students of SHS. Three-tier misconception tests and interviews are research instrument which were used. Students’ misconceptions gained through three tier test, meanwhile interviews were conducted to verify and reveal its causal factors. The research findings show that there are several misconceptions possessed by SHS students of the concept of arthropods. Most of the misconceptions occurred in the concept of classification and identification of the animals’ structure. The errors in representing a certain animals’ characteristics as the criteria of certain taxa was the students difficulty in understanding the concept. There were 22 misconceptions of arthropods was revealed through the three tier test. By this finding teacher was expected to alert the misconceptions by performing a sustainable controlling on students conception whetherin pre and post instructions tasks.

INTRODUCTION

Students were commonly found to possess some conceptions that different with the scientific concept. This kind of conceptions is called as misconceptions (1). Some researcher used another term to note this finding, but this term is used because ‘misconception’ is more familiar in the public (1). Misconceptions in biology occurred in many aspects. Misconceptions were not only found in students’ understanding about the topics (2) but also found in the textbooks (3).

It’s important to overcome the students’ misconceptions. According to Bahar (1) misconceptions is one of the important factors that affect the students learning. So misconceptions in biology should be remediated or corrected. Tekkaya (2) stated that, before misconceptions can be corrected, they need to be identified. If misconceptions didn’t be corrected, it would affect to the students’ understanding on the other related topics in biology.

Identification of misconceptions is one of the teachers’ tasks in the classroom. From the methods mentioned, multiple choices test was the most suitable method to be taken by the teacher. This kind of instrument can be marked immediately and efficiently (4). Besides that, according to Oosterhof (as cited in (4)), multiple choice tend to be more liked by student than another type of instrument. Beside its’ advantages, multiple can’t be
reveal the students’ understanding. In order to solve that weakness, in this research, three tier multiple choice is used to collect students’ misconceptions in arthropods concepts.

Concepts of arthropods was chosen because of member abundance of this phyla. The members such as insects, spiders and many more are commonly found in students’ daily life. Moreover, the scope of the study about misconceptions on zoology commonly done until the difference of the phyla. Because of that, we conclude to use a three tier multiple choice test to reveal the students’ misconceptions of arthropods.

**RESEARCH METHODOLOGY**

This descriptive research was conducted in two phase. The using of three tier misconceptions test was followed by interview to students and teachers. 96 students and three teachers joined this research. They are come from three public senior high school (SHS) in Bandung, West Java. The schools are chosen by stratified random sampling according to clusters system (clusters 1-3). One school from each cluster was chosen randomly. Each chosen school is represented by one class. There are 40 students from SHS A, 31 students from SHS B and 25 students from SHS C.

Three Tier Arthropods Misconceptions Test (TTAMT) is conducted twice. The second tests conducted three weeks after the first test, it’s aimed to see students’ consistency on answering. Both of the tests was held after the formal instruction. The TTAMT consist of 20 items of questions about arthropods (classification, morphological and anatomical structure, role and life cycles of the animals). The first tier consists of one true statement about arthropods and four distractors. In the second tier students have to decide their confidence of the answer. And in the last tier they have to choose possible reasons from the first tier answer. It consist of one true related reason and four distractors. The pattern of students answer then categorized into five level of understanding according to Costu (5) as seen in Table 1. Students’ answers that categorized into level of “misconceptions” with the same pattern on both of tests are collected as the misconceptions data.

**TABLE 1. Category of Students’ Understanding Based on Students’ Pattern of Answer**

<table>
<thead>
<tr>
<th>Level of Understanding</th>
<th>Pattern</th>
<th>Description</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sound understanding (SU)</td>
<td>T-S-t</td>
<td>Students have understanding about the concept, sure about their choice and can relate it to the supporting reason</td>
<td>4</td>
</tr>
<tr>
<td>Partial Understanding (PU)</td>
<td>T-U-t</td>
<td>Students have understanding about the concept and right reason, but they are not sure about its rightness</td>
<td>3</td>
</tr>
<tr>
<td>No Understanding (NU)</td>
<td>T-G-t, T-G-f, F-G-t, F-G-f-U-t, F-U-f</td>
<td>Students don’t have right understanding, they are not sure with the concept, moreover they guess the answer</td>
<td>2</td>
</tr>
<tr>
<td>Partial Understanding With Specific Misconception (PUSM)</td>
<td>T-S-f, T-U-f</td>
<td>Students’ have weak understanding about the concept, sure about their concept, but cannot give the right reason.</td>
<td>1</td>
</tr>
<tr>
<td>Specific Misconceptions (SM)</td>
<td>F-S-t, F-S-f</td>
<td>Students have the false understanding about the concept</td>
<td>0</td>
</tr>
</tbody>
</table>

Adapted from Costu (5)

T,t : True,  F,f : False  S : Sure  U : Unsure  G : Guessing
The interview conducted to the students that possessed misconception according the TTAMT results and to the teacher that teaches the arthropods concept. Interview to the students is aimed to verification the finding in the TTAMT result and to reveal its’ causing factors. Meanwhile interview to the teacher is aimed to find out student condition. The result of the interview then used to support the finding in TTAMT result.

RESULTS AND DISCUSSION

The TTAMT result showed that students possessed some misconceptions about arthropods. According to the result, each school has students that indicated misconceptions. Percentage of students’ misconception is noted in Table 2.

<table>
<thead>
<tr>
<th>School</th>
<th>Misconceptions</th>
<th>Number</th>
<th>Percentage</th>
<th>F (total)</th>
<th>% (Total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>√</td>
<td>14</td>
<td>35,00</td>
<td>53</td>
<td>55,21</td>
</tr>
<tr>
<td>B</td>
<td>√</td>
<td>20</td>
<td>64,52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>√</td>
<td>19</td>
<td>76,00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The TTAMT results are in line with the interview results. 32 students that attended the interview session were indicated to hold at least one misconception. The existence of misconception on the students also recorded in the teacher interview. Teacher from the SHS C stated that her students has unusual idea about caterpillar, they don’t believe that a caterpillar is insect. Scientifically, caterpillar is a larval stage of a butterfly, so it’s exactly an insect.

The TTAMT test found out 22 misconceptions of arthropods. The misconceptions are classified into several main concepts as cited in Table 3.

<table>
<thead>
<tr>
<th>Concepts</th>
<th>Percentage of Students Misconceptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arthropods</td>
<td>2,08% 35,42% 3,13% 8,33% 1,04%</td>
</tr>
<tr>
<td>Arachnids</td>
<td></td>
</tr>
<tr>
<td>Myriapods</td>
<td></td>
</tr>
<tr>
<td>Insects</td>
<td></td>
</tr>
<tr>
<td>Crustacean</td>
<td></td>
</tr>
<tr>
<td>Body Structure</td>
<td>3,13%</td>
</tr>
<tr>
<td>Anatomy</td>
<td>3,13%</td>
</tr>
<tr>
<td>Classification</td>
<td>1,04% 3,13% 15,63% 7,29% 1,04%</td>
</tr>
<tr>
<td>Role of animal</td>
<td>4,17%</td>
</tr>
<tr>
<td>Life Cycle</td>
<td>2,08%</td>
</tr>
</tbody>
</table>

First, in the concept of animal structure, the highest percentage of misconception those 33 students considered that the elongated abdomen of the scorpion is a tail, meanwhile one student said that the elongated posterior of scorpion is a part of its thorax. Scorpion as the member of arachnid has two main parts of the body, cephalothorax and abdomen (6). The second, in concept of anatomy, students considered that antennal gland is an excretory organ of insects and student believe that some insects have no blood. The third, in the concept of role of animal, four students believe that mosquitos are causal factor of malaria diseases. In scientific explanation, mosquitos act as vector of the malaria disease (7). Fourth, in the concept of metamorphosis, students stated that mosquitos and silverfish insect undergo hemimetabola metamorphosis. The last, in the concept of classification, the highest percentage of misconception is in the case of myriapods classification, seven students possessed misconceptions in classifying millipede as
Millipedes have two pair of legs in each abdominal segment, so it’s classified into diplopoda not chilopoda (8). The misconceptions of arthropods according to TTAMT results and it distribution on three school can be seen in Table 4.

**TABLE 4. Profile of Existence of Misconceptions in Three SHS**

<table>
<thead>
<tr>
<th>Questions Number</th>
<th>Misconceptions</th>
<th>F (SHS)</th>
<th>F Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arthropods has 3 pair of legs</td>
<td>- 2 2</td>
<td>2,08</td>
</tr>
<tr>
<td>2</td>
<td>Bat and little bird are arthropods</td>
<td>- 1 1</td>
<td>1,04</td>
</tr>
<tr>
<td>3</td>
<td>Crayfish is not crustacean</td>
<td>- 1 1</td>
<td>1,04</td>
</tr>
<tr>
<td>5</td>
<td>Spider is wingless insects</td>
<td>- 3 3</td>
<td>3,13</td>
</tr>
<tr>
<td>6</td>
<td>Millipede is insects</td>
<td>- 1 1</td>
<td>1,04</td>
</tr>
<tr>
<td></td>
<td>Millipede is chilopoda</td>
<td>1 12 13</td>
<td>13,54</td>
</tr>
<tr>
<td>7</td>
<td>Millipede is chilopoda</td>
<td>- 8 8</td>
<td>8,33</td>
</tr>
<tr>
<td>8</td>
<td>Insects has 3 pair of legs on thorax and abdomen</td>
<td>4 2 6</td>
<td>6,25</td>
</tr>
<tr>
<td>9</td>
<td>Insects have no wings</td>
<td>- 1 1</td>
<td>1,04</td>
</tr>
<tr>
<td>11</td>
<td>Spider has 3 pair of legs on cephalothorax</td>
<td>2 1 3</td>
<td>3,13</td>
</tr>
<tr>
<td>12</td>
<td>Scorpions’ elongated abdominal is its tail</td>
<td>8 13 32</td>
<td>32,33</td>
</tr>
<tr>
<td></td>
<td>Scorpions’ elongated abdominal is modified part of thorax</td>
<td>- - 1</td>
<td>1,04</td>
</tr>
<tr>
<td>14</td>
<td>Swimmeret on crayfish functioned for holding its prey</td>
<td>1 - 1</td>
<td>1,04</td>
</tr>
<tr>
<td>15</td>
<td>Millipede’s legs are pseudopodia</td>
<td>- 2 2</td>
<td>2,08</td>
</tr>
<tr>
<td>16</td>
<td>Insect has no blood</td>
<td>1 - 1</td>
<td>1,04</td>
</tr>
<tr>
<td>17</td>
<td>Mosquito is casual factor of malaria diseases</td>
<td>- 4 4</td>
<td>4,17</td>
</tr>
<tr>
<td>18</td>
<td>Green gland is excretory organ of insects</td>
<td>1 1 3</td>
<td>3,13</td>
</tr>
<tr>
<td>19</td>
<td>Mosquitoes undergo hemimetabola metamorphosis</td>
<td>1 - 1</td>
<td>1,04</td>
</tr>
<tr>
<td></td>
<td>Silverfish insect undergo hemimetabola metamorphosis</td>
<td>- - 1</td>
<td>1,04</td>
</tr>
<tr>
<td>20</td>
<td>Caterpillar is not insects</td>
<td>5 1 6</td>
<td>6,25</td>
</tr>
<tr>
<td></td>
<td>Caterpillar and butterfly are two different insects.</td>
<td>- 1 1</td>
<td>1,04</td>
</tr>
</tbody>
</table>

According to TTAMT result, it recorded 55.21% SHS student possessing misconceptions on the arthropods concepts. More than a half of the total students indicated have difficulties in understanding the concepts. 22 misconceptions (Table 4) are distributed to all school. It means that misconceptions occurred in every cluster. This finding in line with statement of Mintzes (as cited in (9)), misconceptions are found in males and females of all ages, abilities, social classes and cultures. In this research misconceptions occurred in SHS students are found in male and female students of all clusters.

Misconceptions on SHS students as found by this research, are also found in research. Student SHS misconceptions about biological concepts also happened in many concepts such as cellular respiration (10), viruses reproduction (11), metamorphosis (12), invertebrates (13) and animal classification (14). This result found that misconceptions of SHS students also occurred in the arthropods concepts.
This research is aimed to reveal what kind of misconceptions that possessed by the students about arthropods. 22 misconceptions are found as the result of TTAMT. Those peculiar concepts can be marked as misconceptions because they are found on students understanding after a formal instruction (Driver & Easley in (9)). Moreover students believe with the rightness of their concepts (4) and it happened consistently in both of the TTAMTs.

Based on the results that mentioned before, students have many misconceptions on arthropods structure (morphological) and its classification. In the case of concept of body structure, students believe that arthropods bear 3 pair of legs. They also believe that arachnids have 3 pair of legs on cephalothorax. The characteristics mentioned (3 pair of legs) is characteristics of insects. We can conclude that insects’ body structure is the most familiar structure in the students. Whatever a kind of arthropods animal that asked, they will represent it in a form of insects. In this case students had fault in generalizing the characteristics of insects to another class of arthropods and phyla. According to Cinici (13), when student learn about animal they tend to think about their own prototype. In this finding, students represented arthropods as insects. So, when they were learn about characteristics of arthropods they tend to think about insects’ characteristics. It has been proved by the interview to students,

I : “what do you think of arthropods?”
B11 : “animal which has wings, a pair of antennae, segmented, triploblastic symmetrical with six legs”
B26 : “animals which has three body parts (segments)
And B5: “It’s like an insect”.

Those answers indicate that students tend to represent arthropods as insects. This finding is in line with (15), he found that student classified every organism which has segmented appendages and crawling as insects. Another misconception is that students believe that spider has 3 pair of legs. This finding is similar to Urones et.al. (16). According to his finding, 12.5% students in his research described spider have six legs. It also represents the characteristics of insects.

Another misconception of concepts body structures of arachnids is that the elongated abdomen on scorpion is a tail. This is the concepts with the highest percentage. It misconceptions is emerged as result of students’ incapability in understanding a ‘term’ or ‘words’ in it scientific context. Tekkaya (2) stated that some misconceptions could be happened from the using of words that have different meaning in daily life and scientific usage. In this case tail is commonly used to describe posterior extremities of the animal, but scientifically tail is a part of vertebrae which only possessed by vertebrates.

In the case of classification of arthropods, misconceptions also happened because the faulty in generalizing and poor of prototype that represent characteristic of certain taxa. Students tend to classify arthropod by its external characteristics. According to Naz & Nasreen (14) misconception in classification of arthropods can be categorized into misconception based on the structure of organisms, misconceptions based on functions of different parts of the body of organism and misconceptions which stated by the students due to the size of the organism or animal.

In order to find out the causal factor of misconceptions, the interview conducted not only to the student but also to the teacher which teachethese concepts. After analyzing the interview, it can be conclude that misconceptions in this research are occurred as the result of interactions between it causing factors. According to Shen (17), misconceptions can be caused by 4 factors such as students self, books, context and method of teaching. In this case, students tend to use textbooks (school textbook) and internet as the main sources of
knowledge of arthropods. Textbook potentially become the source of misconception. There are many misconceptions and errors in the students' textbooks (3). The teachers in this research rarely did verification or depth considerations on what students found from the textbooks and internet. The combinations of those factors possibly to cause the misconceptions that possessed by the students.

CONCLUSIONS

Most of the misconceptions occurred in the concept of classification and identification of the animals’ structure. The error in representing a certain animals’ characteristics as the criteria of certain taxa was the students’ difficulty in understanding the concept. There were 22 misconceptions of arthropods was revealed through the three tier test. By this finding teacher was expected to alert the misconceptions by performing a sustainable controlling on students conception whetherin pre and post instructions tasks.

REFERENCES


Pedagogical Action Justification: Lessons From Classroom Action Research Process Of Student-Teacher Researcher

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Article info

Abstract

Justification of pedagogical action, classroom action research, student-teacher researcher, professional teacher education, professional development

The process of classroom action research (CAR) is known as one way of helping student-teachers researchers (S-tr) fostering their initial professional development. Through justification of pedagogical action which was choosen by S-tr, self study to become appropriate decision maker in teaching process was expected to built. This qualitative study asks how S-tr justify their pedagogy action design in their CAR. The main data sources is 69 research document from 23 S-tr, which are analysed along three phase of professional teacher education (PTE) programme. According to the result there are three main themes which ware used by the S-tr as their pedagogical action justification. Professional judgment, theory-oriented, and practical experience are three main theme of justification that used by S-tr. According to the result, about 52% student-teachers researchers use theory orientation as their argumentation to justify their action design in the first phase of the program. But in second phase of the program the situation change. 52% student teacher-researcher use theory plus practice experience as their justification. Then in the third phase of program this number was increase around 20%. Along the program we found that knowledge of S-tr about pedagogy is important for being a teacher-researcher, specifically as decision maker in teaching process. More important those knowledge offers a valuable potential of professional development for S-tr.

INTRODUCTION

Research process which is done by a teacher-researcher especially CAR has known become one of an effective element in teacher professional development. Without leaving primary duty of teaching in the classroom, teacher able to practice their capability in improving teaching & learning process. In other words teacher can promote their professional development through their daily activities. Teacher can deeply understood what is their problem and simultaneously they improve it through CAR implementation. The importance of CAR process for teacher implies S-tr in PTE to practice it as their initially professional development. CAR process was expected to build a basis for further professional development of S-tr (1).

According to previous research, CAR was embeded in PTE because there were university lecturer which was become S-tr mentored and school teacher as their supervisor (2). CAR is a meta-practice that allow S-tr conducting self study to become appropriate decision maker in teaching process by systematic investigation of practice and colaborate with others. According to research findings which was done previously, CAR under certain condition offers a potential for professional development for S-tr (1). Unfortunately
research by (1) only provide justification of research theme chosen by S-tr in the end of CAR project. Self study of S-tr should be catch up during the process of PTE program. It is important because the critical phase of PTE program which was support S-tr abilities to design and implementing CAR in PTE program can be analyzed.

Unlike research on teacher professional development (TPD) which was already studied recently by (3), (4), and (5), research about PTE programme in Indonesia is still limited. Therefore this research is needed and important especially because of Indonesian government policies about teacher recruitment and teacher profession, the law for teacher and lecturer No.14/Year 2005. According to those explanation, this longitudinal research was done to find out development of Indonesian S-tr justify their pedagogical action design in CAR during PTE.

**METHODS**

**The Context**

In Indonesia there are two different routes to becoming a teacher in secondary school according to recent policy. One is four year undergraduate teacher education programme with one year PTE programme. The other, in which this study took place, is four year undergraduate non-education programme with one and a half year PTE programme. In this second programme, S-tr do their undergraduate degrees either in science/mathematics or in other subject. Research subject in this study was did their undergraduate from biology department.

Pedagogy specific content knowledge was given in three phase of PTE programme. First, matriculation phase at universities. Second, workshop and peer teaching phase at universities. Third, teaching practice at school that was choosen by universities. Individual CAR project was done by the S-tr along the three phases during the PTE programme. In the first and second phases, S-tr practice to planning CAR integrated with the programme. S-tr practice to implement CAR at their practice school in the third phases mentored by university lecturer.

**Methodology**

This paper is based on analysis of S-tr CAR report and plan document. Research process was done longitudinal along the PTE programme. 69 document belong to one cohort of S-tr (n=23) in three phases of PTE programme were collected. Closer anayses of S-tr pedagogical action justification was done by following steps modified from (1). The steps are: 1) reading and obtain overview of each document; 2) reading throughly, and focusing in to research focus; 3) making a matrix based on the CAR document of S-tr in each phases; 4) reading and looking for quotes 5) final reading. To validate the research finding, meta-discussion with the S-tr about their argumentation that used to justify their pedagogical action was done in last programme.

**FINDINGS AND DISCUSSION**

The 69 CAR document analysed in depth address three different themes of pedagogical action justification. Professional judgment, theory-oriented, and practical experience are three main theme of justification that used by S-tr along PTE programme. This result is different with previous research by (1) that found six theme that used as S-tr
justification. Three theme that did not found in this research are value, need for personal improvement, and observation of the specific class. The result is presented in Table 1, illustrated with example from CAR document.

Table 1. Justification Of Pedagogical Action Along The PTE Programme

<table>
<thead>
<tr>
<th>Justification</th>
<th>Description</th>
<th>Example of quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional judgment</td>
<td>S-tr justification was based on subject matter characteristic theoretically and integrated with pedagogy knowledge</td>
<td>“…there is biology content which abstract, so that learning media is needed to decrease those abstract degree”.</td>
</tr>
<tr>
<td>Theory</td>
<td>S-tr justification was only theoretically based</td>
<td>“…number head together teaching methods give student opportunity to communicate with their friends”.</td>
</tr>
<tr>
<td>Practical experience</td>
<td>S-tr justification was based on practical experience previously</td>
<td>“…reward given in learning process cause students competing each other finishing their task”.</td>
</tr>
</tbody>
</table>

First justification of pedagogical action which is used by S-tr was professional judgment. According to the theme description, S-tr already use their literacy of instruction. This result is appropriate with research finding by (6) which is describe that there was implication of CAR implementation in to teaching literacy. Second theme which is used by S-tr was theoretically argumentation. Actually this theme no less important than previous one which is used by S-tr. The third theme which is used by S-tr was practical experience. This theme basically is known not fully owned by S-tr. As previously describe, S-tr have real teaching experience only in the third phase of PTE programme.

In Figure 1. proportion of S-tr which is used each theme of pedagogical action justification along the PTE programme is presented.

Figure 1. Justification of pedagogical action along the PTE programme

If we seen in Figure 1. There is a difference of theme choosen by S-tr in each phase along the PTE programme used as their pedagogial action justification. Theme number 1 is professional judgment, number 2 is theory, number 3 is practical experience. Some S-tr were use more than one theme of pedagogical action justification, so that combination of different theme was found. First combination, number 1 and 2 for professional judgment and theory. Second combination, number 2 and 3 for theory and practical experiences.

Most of S-tr were use theory theme as their justification of pedagogical action in the phase 1. About 52.17% S-tr were used this theme number 2. This number was change in the phase 2. Most of S-tr were used theme combination of theory and practical experience.
as their justification of pedagogical action in the phase 2. About 52.17% S-tr were used this theme number 2 and 3. In the third phase, theme combination of pedagogical action justification that used by most of S-tr was similar with the theme in the second phase. But the S-tr proportion which were used that theme combination was increase. About 69.56% S-tr were use theme combination number 2 and 3.

According to the result most of S-tr had more than one theme justification for their pedagogical action choose. This result was found similar with research by (1). However there was a tendency towards researching something outside S-tr needed. According to McNiff in (1) actually CAR was started with the critical question: how can I improve my work?. But from the found that justification of pedagogical action used by S-tr there was no personal reason from S-tr which was act as teacher and researcher in the same time. From this data we found that almost S-tr still do not understood clearly about nature of CAR in their future profession as teacher. Pedagogical action that used was justify as a new treatment which was fix the classroom problem. Pedagogical action not seen as their result of reflection along their authentic experience in classroom. Practice period which was limited is one of the main challenge conducting CAR in PTE programme. Besides that, what mattered was how S-tr reflected upon their CAR plan and implementation processes during PTE programme and continue later in their future professional carrier. Hopely S-tr not only seen CAR as teacher task but seen this as teacher need. CAR should seen as away of understanding teaching that they will make use in the future rather than a project (7).

REFERENCES

The Effect of Learning Nature of Science In Classroom Toward Decision-Making And Students’ Views On The Nature Of Science Through Sosioscientific Issues

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Abstract

This study investigated the influence of two different ways in using nature of science through sosioscientific issue of the high school students’ views on the nature of science and decision-making. Participants of this study were students of grade XI science program at SMAN 4 Bandung. Students were taught by applying pretest and posttest design. Instruments View of Nature of Science Questionnaire form B developed and adapted from Lederman et al. (2002) was used to capture student’s view of nature of science and the Decision-Making Questionnaire adapted from Bell & Lederman (2003) and used an approach to make a framework for decision-making by McDaniels et al. (1999) to capture students’ decision-making. Data that captured by VNOS-B were grouped into naïve, intermediary and informed. In DMQ, the percentage of aspect decision-making framework were compared. These results indicated that students’ view of the nature of science through sosioscientific issue was increased especially aspect of tentative, social & culturally embedded and creativity & imagination. In the other hand, only some students who apply the nature of science aspects in their decisions (tentative, creative, subjectivity, social and cultural embedded).

INTRODUCTION

Science is a method to search an explanation of the natural world, a way of knowing define as nature of science (Bell, 2008). The way of knowing needed in science education, in Indonesia, nature of science was mentioned in the rational of curriculum 2013. Nature of science is one of the efforts to achieve the goal of science education, that is generate the student to have scientific literacy. Generally described, a person with the ability of scientific literacy must develop understanding of concepts, principles, theories and scientific processes, and sensitivity between the complexity of the relationship between science, technology and society (Abd-El-Khalick & BouJaoude, 1997).

Five aspects of the nature of science that appears in this study according to Lederman et al. (2002). Scientific knowledge based on empirical, scientific knowledge is tentative, scientific knowledge is the result of creative thinking, science is a social activity that has a relationship of subjectivity and theory-laden. By understanding the nature of science, students are developed to become someone who has a high order thinking skills and able to solve a problems, make decisions, critical thinking, creative thinking and have scientific literacy (Bell, 2009). One strategy that can be used by teachers in implementing nature of science in classroom is using socioscientific issues (Khishfe, 2012). The nature of science learning through socioscientific issue can help students’ decisionmaking. Decision-making is important in the development of students’ scientific literacy, which is a key to creating a democratic society. Klosterman and Sadler (2010) said that learning
through socioscientific issues can enhance students' thinking skills in understanding nature of science. Acar et al. (2010) said that students’ poor argumentation in the context of socioscientific issues has become a concern in science education. Identified problems associated with student argumentation in socioscientific issues are misevaluation of evidence, naïve nature of science conceptualizations, and inappropriate use of value-based reasoning. This is because students do not understand the nature of science. If the vulnerability is left to the learning objectives of science is creating students who have scientific literacy will not be achieved. This can caused the student would not be solve the difficult problems that exist in the community (Acar et al., 2010). Accordingly, study about the effect of the nature of science through socioscientific issues need to be done.

RESEARCH METHODOLOGY

This study aims to investigate the effect of learning nature of science through socioscientific issue of the students’ views about nature of science and decisionmaking related to socioscientific issues. The method that used in this study was pretest-posttest design and compared the different approach of learning nature of science through socioscientific issues in two classes. One class was used implicit approach and the other hand used explicit-reflective approach. Learning the nature of science with implicit approach was the delivery aspects of the nature of science is indirectly or implied in the article socioscientific issue further given the students answer the questions that led to the aspect of the nature of science. Answers about the nature of science aspects further were discussed through class discussion. Learning the nature of science with explicitreflective approach was teacher clearly teach about the nature of science aspects through socioscientific issue and written in the lesson plan. Reflective was the reinforcement of the aspects of the nature of science at the end of the lesson. Participants of this study were 75 second grade student in science department. Two class was used in this research consists of 35 students. Participants were Indonesian with an average age ranges between 15-18 years old. The instrument that used in this study was Views of Nature of Science Questionnaire (VNOS) form B were adapted and developed by Lederman et al. (2002) and the instruments that used in the notice of decision making was DMQ (Decision-Making Questionnaire) and used of decision-making framework approach proposed by McDaniels et al. (1999). Socioscientific issue that used in this research was about artificial muscle and artificial blood.

RESULTS AND DISCUSSION

Nature of Science

Data from the questionnaire VNOS-B adaptation classified into three groups: informed, intermediary and naïve. The grouping analysis refers to a constructivist view of the nature of science according to Lederman et al. (2002). Students were grouped into naïve if the student showed a view of misconceptions about the nature of science. Students were grouped into informed when the student showed a view in accordance with the constructivist view about nature of science by Lederman et al. (2002). The students were grouped into intermediary if they had a transition answer or views were partly informed and partly naïve. Questions of the questionnaire given to the nature of science consists of five aspects. The question posed to capture the students’ views about science based on empirically, theory-laden nature of scientific knowledge, creative and imaginative of scientific knowledge, social and cultural aspects that embedded to scientific knowledge.
Based on the table above, it could be seen that the learning of nature of science through socioscientific issues could enhance students' views on nature of science. The significant increase of those aspects were social and cultural aspects, creativity and imagination, and tentative. Percentage of empirical aspects at of both class at pretest and posttest were 100% informed. Based on the table above, the differences of informed views at pretest-posttest in the theory-laden aspects were slightly increase. Further explanation of the increase and decrease in the percentage of aspects of the nature of science more clearly discussed in the presentation below.

Science based on empirical

The first question was about an empirical science based on how scientists know that global warming have been happening. The results was either implicit or explicit class was belonged to the category informed because all (100%) participants discovered that “the earth’s temperature continues to rise, polar ice began to melt and a little bit of these facts, they studied about the causes of global warming”.

The answer was appropriate because the students explained that scientists used observations to the natural world. Data from observations used as evidence that global warming had been happening. Based on Table 1, implicit class or explicit-reflective (100%) had a same view according to Lederman et al. (2002). It is difficult to analyzed which one of the class had better informed views of the empirical aspects. At posttest, informed students’ informed views on explicit class-reflective more aware about observation and inference, and can distinguish observation and inference aspect better than implicit class.

Explicit-reflective class more aware about inference and observation because teacher was clearly categorized the nature of science aspects in this class, that causes students in explicitreflective class more aware that science is based on empirical and can distinguish the sense of observation and inference. This results are consistent with research conducted by Khishfe, (2012) learning nature of science through socioscientific issue with an explicit-reflective approach could enhance the informed views on the empirical aspects (12% to 58%). Theory-laden. The results was showed that informed views of theory-laden was increased (2.8%) in implicit class and an increased of 8.6% on the explicitreflective class. Students that included in the informed category wrote that “theory and the law of otherscientists could used as the basis, the reference and comparison”. An example that

| TABLE 1. Percentage of students’ view about nature of science |
|----------------|----------------|----------------|----------------|----------------|
|                | Empiric | Theory-laden | Social & culture | Creativity & imagination | Tentative |
|                | pre     | post     | pre     | post     | pre     | post     | pre     | post     |
| Implicit       |         |          |          |          |         |          |         |          |
| Informed       | 100     | 100      | 80      | 82,9     | 34,3    | 62,9     | 71,4    | 77,1     | 42,9    | 71,4    |
| Intermediary   | 0       | 0        | 20      | 14,3     | 25,7    | 20       | 17,3    | 20       | 25,7    | 17,1    |
| Native         | 0       | 0        | 0       | 0        | 0       | 0        | 0       | 2,9      | 0       |
| Not answer      | 0       | 0        | 0       | 0        | 0       | 0        | 0       | 2,9      | 0       |
| Explicit-reflective |         |          |          |          |         |          |         |          |
| Informed       | 100     | 100      | 77,2    | 85,8     | 25,7    | 65,7     | 74,3    | 91,4     | 65,8    | 97,2    |
| Intermediary   | 0       | 0        | 22,9    | 14,3     | 28,6    | 22,8     | 8,6     | 8,7      | 14,3    | 2,9     |
| Native         | 0       | 0        | 0       | 0        | 0       | 45,7     | 11,6    | 17,1     | 0       | 17,2    | 0       |
| Not answer      | 0       | 0        | 0       | 0        | 0       | 0        | 0       | 0        | 0       |

Bandung, October 17th, 2015
student used to clarified answer was artificial blood used K. Landsteiner theory as the theoretical basis for the manufacture of artificial blood. "scientists do not stand alone, scientists require other scientists in finding the product of science and in the attachment process occurs between one scientist with other scientists".

On the nature of science-based learning using socioscientific issue of artificial blood lead in the second grade students can reveal that scientists need of theory and research scientists previously so learning to use this socioscientific issues can improve the informed views on aspects of theory laden. Although the learning nature of science through socioscientific issues could improved the informed views, but the difference was slightly between this comparison class. Percentage of informed views on the posttest in explicit-reflective class was (85.8%), in the other hand, implicit class was (82.9%). These results were consistent with study by Khishfe (2012) that there is an increased view of the subjective aspects (theory laden) (68%) in the class with an explicit-reflective approach of the nature of science learning using socioscientific issue. **Social and cultural aspect.** The result showed that informed views of social and cultural aspects embedded was increased after students learned about nature of science through social scientific issues. In the implicit class, the percentage was increased from 34.3% to 62.9% and the explicit class-reflective increased from 25.7% to 65.7%. Based on the end result, differentiation between two class was slightly increased, but the increase of percentage on the informed category in explicit-reflective class was more significant than implicit class. The examples informed student answers in response to questions about the social and cultural role in science and technology of artificial blood is as follows, "yes, social and cultural aspect can affect science. Scientists must follow the rules that exist in the environment. Scientist should make the technology that can be well accept in the society."

Based on the results of the questionnaires, it could be seen that the learning nature of science through socioscientific issues could increase the percentage of informed both in explicit-reflective class and implicit class. Socioscientific issues that used in this study was about the discovery and development of technology of artificial blood and artificial muscle in the community. On the socioscientific issue, the article told how the technology is accepted in society. The result was leaning of nature of science through socioscientific issues effective in explaining that science and technology can affect and can be affected by social and cultural rights and can be evidenced from the results VNOS-B adaptation that the result showed that the percentage of informed increase in posttest in both classes. Although the difference in the end of result was not significant, but the explicit-reflective class was slightly better than implicit class. Results from this study were consistent with research by Eastwood et al. (2012) students who get the nature of science learning used socioscientific issue better in explaining the nature of science, especially in the social and cultural aspects (61%). **Creativity and imagination.** On the pretest, the most dominant views was informed. At the implicit class got 71.4% and the percentage of explicit-reflective class was 74.3%. Based on this result, explicit-reflective class was slightly better than implicit class. Percentage comparison of group posttest informed on explicit-reflective class (91.4%) was greater than the implicit class (77.1%). If we correlated the results of the pretest and posttest with learning process, the students could answer the questions about creativity and imagination as well. Students said that, scientists used their creativity and imagination for their research.

The reason that support this statement generally was scientists use creativity and imagination to made artificial blood. Examples of students' answers on the category informed from VNOS-B based on creativity and imagination was, "yes, imagination it required an inventor. Many inventors who invented the science of simple thought through the imagination.". Based on the results of the questionnaire VNOS-B adaptation and
related with learning experience, when the group discussion about artificial blood issue. While the discussion the student agree that “
scientists must be used their creativity and imagination to created an artificial blood”. This result showed that learning nature of science through socioscientific issue effective to improving student informed views especially on informed views at posttest in explicit-reflective class. The results were consistent with the results obtained by Khishfe (2012) that was an increase in the percentage of category informed on the nature of science class learning treatment through socioscientific issue is bigger than the common class. Tentative.

On the pretest, the informed view was the second highest in the class. In implicit class, naïve percentage was larger than explicit -reflective class (17.3% vs 31.4%). The most naïve response was “no, because science is absolute”. The statement does not relate to constructivist Lederman et al. (2002) on tentative. Science, although reliable and durable, it never can be absolute or definite (Lederman et al., 2002). There is a decrease at posttest on naïve category, which means that the second class on the posttest better in view of the tentative aspect. The highest percentage (97.2%) were explicit-reflective class then follow by the implicit class (71.4%). Based on the difference in the percentage of acquisition, it can obtain that the view of informed explicitly-reflective class was much better than the implicit class. At 51.4% from 97.2% at informed view on explicit-reflective class, said that, ”Yes, tentative is exist on scientific knowledge, because theories or laws could change if the new one had more proven accuracy”. While the class discussion, students agreed that science could be changed, “yes, because the theory and law in science can be changed along with times”. Based on the responses of students during the learning, it showed a view of informed category. In the explicit-reflective class, after the students discuss with their group, students will given a reinforcement by the teacher, because of that the result in the explicit-reflective class were higher at the percentage of informed views rather than implicit class. Based on this study, we could seen that learn nature of science through socioscientific issue was more effective in improving student informed view on explicit -reflective class. The results were consistent with the results of the study by Khishfe, (2012) after learning nature of science through socioscientific issue, the percentage informed explicit-reflective class was larger (41%) than the common class (21%).

Decision-making

In the DMQ pretest, students were given questions about students opinion on development and using artificial muscle and in the posttest, students were given a questions about students opinion on artificial blood. Generally, the students were agree with the issue of artificial muscle products and artificial blood for used and developed. Further analysis of the value-based reasoning aspects of the students answered agree or disagree was presented in Figure 1.
Based on Figure 1, in the pretest, only small percentage of nature of science aspect that appears on the pretest, and it was tentative (5.7%) in explicit reflective class. Examples of tentative aspect in the students decision when asked whether agree if the artificial muscle research continues to be done and agree with its use in everyday life. Here are examples of students' answers, "I agree, because the useful of technology must grow up to facilitate people.". At posttest, some of the students indicated an increase in apply knowledge of the nature of science in the final decision (creative and imaginative, tentative and sociocultural). In the explicit class-reflective class, students apply creative and imaginative aspects (8.6%), tentative (5.7%), sociocultural (5.7%) and subjective (2.9%), while only 2.9% of implicit class who applying aspects of the nature of science (tentative and socio-cultural) in decision-making. Based on the results showed that the learning nature of science through socioscientific issue in explicit-reflective class was better than implicit class, but the result of learning the nature of science through socioscientific issue only increases the percentage of aspects of the tentative, creativity, subjectivity and social culture in very small amounts. That because the theme of the socioscientific issue that used in this study was artificial blood and artificial muscle that was closely and related to technology, health, humanitarian and religious. So, it’s normal when the students were considering the decision of the humanitarian aspects, health and religious.

The results were consistent with study by Khishfe (2012). Khishfe (2012) examines learning nature of science through socioscientific issue by explicitly compared with the class that got arguments training on decision-making in lecturing the issue of socioscientific and the result showed that in explicit class there are more students linking aspects of the nature of science in decision-making. Although in this study is consistent with research Khishfe (2012) however, the results that obtained are not yet made all of the students could applied the nature of science in decision-making. A bit increase in the nature of science percentage which better at decision-making is in explicit-reflective class. Meanwhile, the results of this study were not consistent with study by Bell & Lederman (2003). Bell & Lederman (2003) revealed that the nature of learning science can not improve the relationship between the nature of science to decisionmaking. Although a bit less, this study that study investigated the influence of two different ways in using nature of science through socioscientific issue have a better results that there are in explicit -reflective class at the creative and imaginative (8.6%), tentative (5.7%), sociocultural (5.7%) and subjective (2.9%), while the implicit class, the percentage on a tentative and sociocultural aspects was (2.9%).

ACKNOWLEDGEMENTS
Thank you to Indonesia University of Education, FPMIPA to organize MSCEIS, to Drs. H Yusuf Hilm Adisenjaja, M.Sc., Dra. Ammi Syulasmi, M.S., who always supporting this study from the begining. To my familly, my friends and Ridha Fauza for all support.

REFERENCES


Implementation of Authentic Assessment Model in Assessing Biology Teacher Candidates’ Problem Solving Skills on Field Trip Activities

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**Article info**

**Keywords:**
authentic assessment, integrated field trip, problem solving skill, biology teacher education

**Abstract**
This research is aimed to generate tested authentic assessment instrument model which is feasible to be used in assessing problem solving skill of students who are going to be biology teacher candidates in integrated field trips. This research is a part of steps in Educational Research and Development (R & D) activities by implementing previously developed authentic assessment instruments in assessing field trip activity of 30 students of a private university in Bandung, Indonesia who are going to be teacher candidates. The result of this research shows that authentic assessment in integrated field trip activity can be measured directly and it including knowledge, skill, and scientific attitudes that the students applied. Foremost explanations related to assessment techniques and aspects before the practice can encourage the students to perform better field trips to achieve higher study results. Authentic assessment instrument developed in this research has very high validity and reliability to measure study result in cognitive domain (0.877 and 0.949), high reliability in assessing observing skill (0.776 and 0.866), communicating (0.665 and 0.581), writing proposal (0.854 and 0.884), and collecting specimens (0.676 and 0.400), meanwhile the result is average and medium for measuring process noting (0.607 and 0.153) and writing field trip result (0.607 and 0.153). This instrument also has average validity (0.589) and high reliability (0.75) for scientific attitudes measurement. Therefore, it is advised to do further improvements and tests to the authentic instrument developed in this research in order to make it a study result device which has higher validity and reliability.

**INTRODUCTION**

Science education was aimed to make students have science literacy which includes science education including content and process as well as critical thinking skill and problem solving skill. Permendiknas no. 22 year 2006 confirmed that science education (including Biology) ought to be implemented through scientific inquiry. In NSES – NRC (1996), it is stated that scientific inquiry is various ways used by scientists in studying the universe as well as proposing definitions based on evidences gathered from their research. It is stated in Inquiry and the National Science Education Award (NRC, 2000) that developing skill to understand and use inquiry activities need direct experience and sustainable practice.

Note that the success of the study is highly depending towards the competence and quality of the teacher. Therefore, the efforts in upgrading learning quality must be started from the effort of teachers’ competence and quality. Therefore, the result of this attempt must be started from attempts to increase economic value and teacher quality. In order to achieve high standard of biology teacher standard, an effective learning method for the
students is needed. The attempt in giving experience and understanding of biology concepts with inquiry oriented learning method can be done through field trip activity in which the students observe and review the problems directly in the origin habitat adjusted to its function.

Through field trip, students can gain a lot of things if the activity is organized effectively. The chance of direct learning in the field can improve students’ skills in problem solving and thinking critically. Besides, field trip can help students to understand the concept and improve their ability in researching in the level that cannot be achieved through the combination of class learning and laboratorial activity. Patrick (2010) stated that field trip should be done because it (a) gives direct experiences, (b) stimulates interests and motivations toward science; (c) gives meanings of learning; (d) improves participants’ observing and perceiving skills; and (e) affects their personal social development. Besides, Tal (2004) stated that field trip give the students chance to have concrete experiences through (a) a transitional learning step from simple concept to more complex concept; (b) a direct experience with actual phenomenon and tools; and (c) the occurrence of hands-on activities to construct and strengthen abstract concepts. Related to the impact of field trip towards students’ learning result, Patrick (2010) concluded that field trip experiences enhanced students’ understanding of process of science, improved students’ biology and significantly influenced achievement.

Students’ achievement and acquisition for the learning they have done during field trip needs sustainable assessment for them to improve so the learning purpose is reached. In this assessment process, representative tool which can also assess students’ solving problem solving skill accurately is need. According to the characteristics of field trips which combine knowledge, skill, and scientific attitudes in solving problem unit, integrated field trip needs authentic assessment tool. Mueller (2008, as cited in Abidin, 2012) stated that authentic assessment monitors and assess students’ ability in solving various possible problems faced in real life situation or context and in actual learning process.

In the planning step of the research, a requirement analysis has been conducted through interview with 30 students who participate integrated field trip as well as 5 supervising lecturers. The analysis shows that until today, most integrated field trips have not been accompanied with authentic assessment process due to the lack of assessor and the absence of relevant and flexible main instruments. Based on the result of the analysis, a model authentic assessment instrument are developed and those are validated by judgement expert and trials on a limited circle.

This research is the part of development step in which the main activity is examination of effectivity of model plan and authentic assessment instrument which had been developed in the previous step in order to obtain the general description of biology teacher candidate students in solving problems during field trips. The students with high problem solving skill are expected to be more prepared in facing the actual challenge. Besides, through this research, hopefully description of learning process and students’ result from the field are gained, as well as giving knowledge to students who are also candidates of biology teacher regarding assessment model development for field trip, so they have the provision of adequate knowledge in performing their duties.

METHODS

This research was carried out with Educational Research and Development (R & D) design which was developed by Dick and Carey (Gall et al., 2003) with modifications as needed. In practice, this research was designed to be implemented in three major stages,
those are Planning, Developing, and Disseminating stages. Planning stage of this research has been done by generating Authentic Assessment Instrument Model for Assessing Problem Solving Skill in Practice which has been validated through judgement expert and trials on a limited circle.

In the development stage of the research, the application of validated authentic assessment instrument in assessing students’ cognitive, skills, and scientific attitudes aspects who are performing integrated field trip in Karapyak Beach, District of Pangandaran had been done. The students were consisted of two big groups of 30 people each. The first group (control group) is the group who were not given explanations regarding assessment aspects and indicators as listed on developed assessment instrument, and are allowed to conduct field trip according to their knowledge. The second group (experiment group) is the group which given explanations regarding the assessment aspects and indicators before the activity.

Cognitive aspect assessment was focused on students’ problem solving skill with criteria scored with rating scale. The criteria are: 1) The ability to identify problems; 2) The ability to formulate problems; 3) The ability to design solutions; 4) The ability to compile hypothesis; 5) The ability to gain information; 6) The ability to associate informations; and 7) The ability to draw conclusions.

Skill-area assessment is based on performance as well as portfolio assessment. Performance assessment done for especially observation and communication skills, while the other types of skills such as formulating research problems, determining variable, formulating hypothesis, determining research methods, predicting, interpreting observation result and drawing conclusions are depicted on portfolio assessment which consisted of 1) Field Trip Proposal, 2) Field Trip Process Note, 3) Report of Field Trip Result, and 5) Specimen Collections. Each of them have their own assessment criteria determined in developed instrument rubric, so does with practical scientific attitudes assessment which includes 1) sense of curiosity, 2) inventive, 3) critical thinking, 4) self-determination, 5) awareness towards limitation, 6) appreciation of evidences, 7) integrity, 8) objectivity, 9) wills to change opinion, 10) being open-minded and open to group-work, as well as 11) asks attitude, in which each of the aspects are explained into an indicator scored by Likert scale.

Data analysis was conducted with the help of SPSS-14 program in computer. Examination of median comparing between scores of control group and experiment group result was also conducted. To see whether the difference is significant or not, second step, which is normality test of Shapiro-Wilk is conducted to decide what hypothesis test could be done. It includes parametric statistic (t test) or non-parametric statistic (mann-whitney test). If the result of normality test shows normal data distribution, then homogeneity and hypothesis test will be conducted with t test, meanwhile if the data is not normal then hypothesis test will be conducted with mann-whitney test. Based on the assessment score result on every assessment aspect, instrument validity and reliability are also determined through computer testing with the help of SPSS (Statistical and Product Service Solution) - 14 software.

**RESULTS AND DISCUSSION**

The result of cognitive domain assessment of field trip students with developed instrument are presented in Table 1 below.

**Table 1. Recapitulation of Cognitive domain Assessment of Field Trip Students with Authentic Assessment Instrument as the Result of Development of the Research**
Table 1 shows that the average score of both group are different significantly, where the experiment class is more superior compared to control group. Mann-Whitney test shows that cognitive domain of experiment group students are better than control group.

Recapitulation of work method assessment result is presented on table 2. The table shows that average assessment score of observation skill of experiment group is higher by 3,84 points compared to control group, but the statistic test result shows insignificant difference. It means, the observing skill of the students of experiment skill is better than control class, even though the statistic test shows that the difference does not mean anything.

Table 2. Recapitulation of Observation Skill Assessment of Field Trip Students with Authentic Assessment Instrument as the Result of Development of the Research

<table>
<thead>
<tr>
<th>No.</th>
<th>ASSESSMENTS ASPECTS</th>
<th>AVERAGE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control Group</td>
</tr>
<tr>
<td>1</td>
<td>Ability to identify problem</td>
<td>2.20</td>
</tr>
<tr>
<td>2</td>
<td>Ability to formulate problem</td>
<td>2.40</td>
</tr>
<tr>
<td>3</td>
<td>Ability to design solution</td>
<td>2.20</td>
</tr>
<tr>
<td>4</td>
<td>Ability to design hypothesis</td>
<td>2.33</td>
</tr>
<tr>
<td>5</td>
<td>Ability to obtain information</td>
<td>2.00</td>
</tr>
<tr>
<td>6</td>
<td>Ability to associate information</td>
<td>1.93</td>
</tr>
<tr>
<td>7</td>
<td>Ability to draw conclusion</td>
<td>2.20</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15.26</td>
</tr>
</tbody>
</table>

Table 3 shows that the average score of speaking skill assessment of experiment group is better by 1.50 point compared to control group. Mann-Whitney test and difference level test (N-Gain) through t-test of a sample shows that communication skill of the experiment group students are better than those of control group with significant difference.

Table 3. Recapitulation of Speaking and Learning Skill Assessment of Field Trip Students with Authentic Assessment Instrument as the Result of Development of the Research

<table>
<thead>
<tr>
<th>No.</th>
<th>ASSESSMENTS ASPECTS</th>
<th>AVERAGE SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Control Group</td>
</tr>
<tr>
<td>1</td>
<td>Using the senses</td>
<td>2.60</td>
</tr>
<tr>
<td>2</td>
<td>Observing special features of observed objects and environments</td>
<td>2.63</td>
</tr>
<tr>
<td>3</td>
<td>Identifying the difference and similarity of observed objects</td>
<td>2.00</td>
</tr>
<tr>
<td>4</td>
<td>Determining sequence of events</td>
<td>1.97</td>
</tr>
<tr>
<td>5</td>
<td>Using tools to sharpen the senses</td>
<td>3.00</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>12.20</td>
</tr>
</tbody>
</table>
The average score of Field Trip Proposal resulted from experiment group students is higher by 5,00 points compared to those of control group. The result of Mann-Whitney and N-Gain test confirmed that significantly the average score of field trip proposal assessment of experiment group students is higher than control group.

The skill to take note of observation process and result in a field trip is one of the skills that are very important to be mastered to ease the students during the interpreting process as a whole. In this research, skill of taking note is considered through: 1) Observation Result Notes; 2) Converting Observation Notes to Table Form; and 3) Converting Observation Notes to Graphic Form. Briefly, statistics analysis result shows that experiment group have significantly better ability in making field trip process note, with the difference of average score of 1,40 points compared to control group.

Report of Field Trip Result is the climax product of a field trip. Everyone who learn through natural observation must have the ability to write field trip report in order to make their findings scientific information for those who need it. In this research, the ability to write reports is measured through the following aspects: 1) The suitability of writing format with the applied provision; 2) Language; 3) Aesthetics; 4) Title; 5) Problems; 6) Hypothesis; 7) Methods; 8) Data Analysis; 9) Findings and Discussions; and 10) Conclusions. Briefly, the result of statistics analysis shows that report made by experiment group is significantly better with the difference of average score of 11,23 compared to those made by control group. It means, experiment group have better ability to write field trip report compared to control group.

Specimen collection is one of the way to make the learners getting close to the source of learning. Hence, specimen collection should be in the same condition as the original, which makes the accuracy of treatment procedures during specimen collecting process is needed. Besides, specimen collection must be selective according to the learned concept. Therefore, in this research the ability to collect specimen is measured through the outcome products (preserved specimens) with the aspects of: 1) Procedural provisions, 2) Concept suitability; and 3) Aesthetics. Briefly, the result of data analysis of specimen collection ability assessment shows significantly that specimens collected by experiment group is better than those of control group, with average score difference of 2,10.

The usage of authentic assessment instrument during scientific attitudes assessment and the result of statistical analysis shows that students on experiment group have scientific attitudes that is generally have better average score significantly compared to students on control group, with the difference of average score of 5,26 points.

Generally, the result of cognitive, skill, as well as scientific attitudes assessment of field trip student during the activity shows that the students whom given explanations regarding assessment aspects and indicators as written on assessment instrument before the activity, could gain better learning result compared to the other group. This is occurred because by knowing the assessment aspects, students are challenged to show their best
performance, willing to gain more knowledge by themselves and have more scientific attitudes during the field trip.

Based on the assessment score gained from each assessment aspect, validity and reliability of the instrument are determined through computer test with the help of SPSS (Statistical and Product Service Solution)-14 software. The table below presents the recapitulation of the test result.

**Table 5. Recapitulation of Validity and Reliability Test Result of Authentic Instrument for Assessing Integrated Field Trip of Biology Teacher Candidate Students**

<table>
<thead>
<tr>
<th>No.</th>
<th>ASSESSMENT ASPECTS</th>
<th>VALIDITY</th>
<th>RELIABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Score Category</td>
<td>Score Category</td>
</tr>
<tr>
<td>1</td>
<td>Cognitive domain</td>
<td>0.877 Very High</td>
<td>0.949 Very High</td>
</tr>
<tr>
<td>2</td>
<td>Skills (Work Method)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Observation</td>
<td>0.776 High</td>
<td>0.866 High</td>
</tr>
<tr>
<td>b.</td>
<td>Communication (Speaking)</td>
<td>0.665 High</td>
<td>0.581 Medium</td>
</tr>
<tr>
<td>3</td>
<td>Skills (Portfolio)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a.</td>
<td>Field Trip Proposal</td>
<td>0.854 Very High</td>
<td>0.884 High</td>
</tr>
<tr>
<td>b.</td>
<td>Field Trip Process Note</td>
<td>0.607 Average</td>
<td>0.153 Very Low</td>
</tr>
<tr>
<td>c.</td>
<td>Field Trip Result Report</td>
<td>0.607 Average</td>
<td>0.153 Very Low</td>
</tr>
<tr>
<td>d.</td>
<td>Specimen Collection</td>
<td>0.676 High</td>
<td>0.400 Medium</td>
</tr>
<tr>
<td>4</td>
<td>Scientific Attitude</td>
<td>0.589 Average</td>
<td>0.750 High</td>
</tr>
</tbody>
</table>

The results show that developed authentic assessment instrument is able to measure students’ learning result on cognitive domain, skills, and scientific attitude at once in one field trip. This is in accordance with Mueller’s (2008, as cited in Abidin, 2012) statement which says that authentic assessment should be able to measure, monitor, and assess all the learning result aspect (which are contained in cognitive, affective, and psychomotor domain) in one learning process, whether as the final result of a learning process or as the activity change and development, and the learning result from both inside and outside of classrooms.

The result also shows that developed authentic assessment instrument in this research has very high validity and reliability to measure learning result in cognitive domain, has high validity and reliability in assessing observation, communication, proposal writing, and specimen collection skills, but only up to category average and medium for measuring process noting and field trip result report writing skills. Based on the results, it is advised in the future to conduct reviews and revisions regarding the part of instrument in which the validity and reliability are not adequate, because aside from the consistency, validity of the instrument is also needed. The validity of assessment instrument is related with the suitability between the instruments with the assessed aspects. A measuring tool is valid if it can measure precisely (Sudjana, 1995).

**CONCLUSIONS**

Based on the result, it can be concluded that:

1) Authentic assessment in integrated field trip activity can be measured directly and it includes students’ knowledge, skills, and scientific attitude.

2) Explanations given regarding techniques and assessment aspects before the activity can stimulate the students to perform better field trip activity.
3) Preceding explanations of techniques and assessment aspects before the activity can stimulate the student to earn higher learning result, whether it is in the area of knowledge, skills, or scientific attitudes.

4) Authentic assessment instrument developed in this research has very high validity and reliability in measuring learning result in cognitive domain, high validity and reliability in assessing observation, communication, proposal writing, and specimen collection skills, but only average and medium for measuring process noting and field grip report writing skills.

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Proceeding International Seminar on Mathematics, Science, and Computer Science Education

BIO-05335

Portraying Students’ Ability in Making Student Worksheets: The First Step in Improving Prospective Teachers’ Quality Through Developing Scientific Project-Based Student Worksheets

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Article info

Abstract

Research with the main objective to produce a model LKS (student worksheet) based scientific project that has a characteristic and tested in accordance with the demands of the curriculum in 2013 making it feasible to use in assessing the skills of thinking creative who have science process skills and lead to a positive feed-back form of the formation of attitudes science for student teachers, especially science and generally for learners in schools. This study is very important to be done considering the number of worksheets that circulated in schools is not in accordance with the characteristics of LKS in developing hands-on and mind-on. With the development of project-based scientific LKS expected to be identified LKS models integrated with scientific methods (scientific method), individual profiles of students in developing the ability creative and feasibility of the model field. In time, improvements to the student assessment results uncategorised low, buffer immediately done, so that at the end of the lesson is expected to emerge personalities of students who are proficient designing and assembles various models of worksheets that assesses the ability to think kreative are ready to face real challenges in the execution of their duties duania later. Based on the results of a needs analysis conducted by researchers, research has been conducted in accordance with the schedule of activities and has been running with a progress report as much as 70% and the remaining 30% of activities are still underway to complete the data and improvements that need for improving the results of the model developed.

INTRODUCTION

With the implementation of Curriculum 2013, LPTK as universities that are mandated by the government to provide teachers (UU No. 14/2005) have duty and responsibility to provide quality learning program to produce quality teachers. To enable their graduates to compete in the field, LPTK endeavor to improve their quality by increasing the mastery of the four teacher’s standard competences: pedagogic, professional, social, and personal competences, as stipulated in Permendiknas No. 16 Tahun 2007. The endeavor to develop the competences and to deal with the implementation of Curriculum 2013, appropriate learning methods, models and strategies that nurture prospective teachers’ teaching competences are needed.

One of the most important skills in teaching is making teaching materials. There is a tendency that most Indonesian teachers’ ability in making teaching materials is low. An indication of that hypothesis is that most teachers rely on LKS (student worksheets), which are offered by LKS publishers. Yet, based on the researcher’s analysis, most LKSs do not sufficiently assess students’ skills in science process and creative thinking. Most LKS only
provide important points of particular material but do not explain them thoroughly. Most parts of LKS consist of multiple choice or essay exercises, excluding practicum or laboratory assignments; when they do include them, the activities are only simple experiments that do not require students to think creatively. The analysis results imply that most LKS do not include science process and indicate that teachers are reluctant to make their own student worksheets. It is also supported by the findings from researchers’ observation on PLPG (Teacher’s Professional Training and Workshop), in which teachers found it difficult to make their own LKS because they are not used to making their own student worksheet.

From those initial findings, it seems that there is a need to conduct a research emphasizing on developing teachers’ ability in making student worksheet. Thus, the researchers formulated a research question: “How can developing scientific project-based worksheet model improve prospective teachers’ quality?” From the question, this study was expected to 1) develop a scientific project-based LKS model that is in accordance with the Curriculum 2013, 2) to identify biology prospective teachers’ profiles in making scientific project-based LKS model, and 3) to improve the quality of biology prospective teachers’ quality, particularly in making scientific project-based LKS model. Hence, from theoretical perspective, the research would contribute on science in education in improving education quality and from practical perspective, the research would contribute in providing effective and tested learning media for LPTKs in improving the quality of their graduates, which leads to competent teachers and improved education quality.

RESEARCH METHODS AND DESIGN

Based on its problem characteristics and aims, the study employed Educational Research and Development design with some modifications in some parts. The research was conducted in Biology Education Study Program of a private LPTK in Bandung, involving 30 senior students of Biology Department, who had completed 80% of their overall study in the university. The research is designed using Dick and Carey’s educational R & D model, which consists of several phases namely 1) preliminary study, 2) research planning, 3) early product development, 4) developing prototype product, 5) validation on developed model and instrument, 6) limited field test, 7) implementation of valid model and instrument, 8) analysis on developed model and instruments, 9) interpretation of data analysis result, and 10) research product dissemination (Gall et al., 2003). The research was designed to be completed within three years, with planning as the focus of the first year, and developing and disseminating as the foci of the second and the third year respectively.

As the study is in its first of three-year-study, it focused on planning the study, which covered phase 1-4 of Dick and Carey’s model. In this phase, the prospective teachers were asked to fill open and closed questionnaires. The open questionnaires were designed particularly for the students to design student worksheet drafts. Several open questionnaires were made; each represents particular type of learning approach and students had to fill it with activities that are appropriate to the approach.

RESULTS AND DISCUSSION

The following table shows the result of the open questionnaires filled by the students.

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of LKS form</th>
<th>Skill identification</th>
<th>Result (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
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</table>

Bandung, October 17th, 2015
<table>
<thead>
<tr>
<th></th>
<th>Problem-based Learning</th>
<th>Scientific Practicum topic</th>
<th>Observation</th>
<th>Experiment</th>
<th>Observation</th>
<th>Discussion</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Making Practicum topic</td>
<td>Practicum topic</td>
<td>2.43</td>
<td>3.97</td>
<td>3.00</td>
<td>2.37</td>
<td>2.83</td>
</tr>
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<td></td>
<td>Observation</td>
<td>Observing</td>
<td>2.60</td>
<td>3.43</td>
<td>3.00</td>
<td>2.37</td>
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</tr>
<tr>
<td></td>
<td>Problem</td>
<td>Asking</td>
<td>2.60</td>
<td>3.67</td>
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<td>2.37</td>
<td>2.83</td>
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<td></td>
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<td>Reasoning</td>
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<td>Experimenting</td>
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<td>Assumption</td>
<td>Networking</td>
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<td>3.00</td>
<td>2.37</td>
<td>2.83</td>
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<td>Reasoning</td>
<td>2.90</td>
<td>3.27</td>
<td>3.00</td>
<td>2.37</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Used tools and equipments</td>
<td>Steps</td>
<td>2.70</td>
<td>2.70</td>
<td>2.37</td>
<td>2.37</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Steps</td>
<td>Observation table</td>
<td>2.70</td>
<td>2.70</td>
<td>2.37</td>
<td>2.37</td>
<td>2.83</td>
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<tr>
<td></td>
<td>Observation result graphic</td>
<td>Problem formulation</td>
<td>2.90</td>
<td>2.37</td>
<td>2.37</td>
<td>2.37</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Discussion</td>
<td>Conclusion</td>
<td>2.90</td>
<td>2.37</td>
<td>2.37</td>
<td>2.37</td>
<td>2.83</td>
</tr>
</tbody>
</table>

|   | Project-based Learning | Determining problem to be observed | 2.00  | 2.10       | 2.37       | 2.37       | 2.83       |
|   | Determining project title | Formulating problem | 2.20  | 2.21       | 2.37       | 2.37       | 2.83       |
|   | Formulating questions | Determining project theme | 3.10  | 3.10       | 2.37       | 2.37       | 2.83       |
|   | Determining visiting plan | Determining visiting plan | 1.90  | 1.90       | 2.37       | 2.37       | 2.83       |
|   | Developing temporary answer | Developing temporary answer | 2.22  | 2.22       | 2.37       | 2.37       | 2.83       |
|   | Making report | Making report | 1.90  | 1.90       | 2.37       | 2.37       | 2.83       |
|   | Concluding | Concluding | 2.50  | 2.50       | 2.37       | 2.37       | 2.83       |

|   | Inquiry | Practicum topic/title | 3.80  | 3.43       | 3.77       | 3.77       | 4.20       |
|   |         | Experiment objectives | 3.43  | 3.43       | 3.77       | 3.77       | 4.20       |
|   |         | Problems               | 2.77  | 2.77       | 3.77       | 3.77       | 4.20       |
|   |         | Problem formulation    | 2.97  | 2.97       | 3.77       | 3.77       | 4.20       |
|   |         | Problem priority selection | 2.23  | 2.23       | 3.77       | 3.77       | 4.20       |
|   |         | Determining tools and equipments | 3.27  | 3.27       | 3.77       | 3.77       | 4.20       |
|   |         | Determining experiment procedures | 3.20  | 3.20       | 3.77       | 3.77       | 4.20       |
|   |         | Making observation table | 2.23  | 2.23       | 3.77       | 3.77       | 4.20       |
|   |         | Findings and discussion | 2.37  | 2.37       | 3.77       | 3.77       | 4.20       |
|   |         | Conclusion             | 2.40  | 2.40       | 3.77       | 3.77       | 4.20       |

From the table above, it can be seen that although students had taken 80% practicum classes, most of them have relatively low skills in several areas. In filling open questionnaire on Project-based Learning (PjBL), students’ low skills lie on observing, determining hypothesis, making assumption, filling observation table and filling observation graph. This fact implies that there has to be exercises that require students to solve problems by doing practicum projects. That way, the practicum would be more meaningful for students and meet the demands for reasoning skills in Curriculum 2013.

The scientific-based student worksheet drafts made by the students reflect that the students’ ability in reasoning and networking. For project-based learning (PjBL), the drafts made by the students reflect that students’ skills in identifying problems to be observed, gathering references, determining visit plan, planning a project, and making a project report are relatively low. The students’ medium skills are identified at formulating research questions, determining project theme, determining project title, developing temporary
conclusion, and concluding. None of the students has high skill in any of the measured aspects.

For the inquiry-based student worksheet, the students’ skills are low in making observation table. While for medium level, the aspects are determining experiment’s objectives, identifying problems, formulating research questions, determining problem’s priority. The only aspect, in which the students have high skill, is in making research title.

These preliminary findings serve as the basis for developing scientific-project-based worksheet template from which tested and reliable worksheet for assessing students’ creative thinking skill can be developed. This research however is still on progress by as much as 70% with 30% of its overall research is still being conducted.

**CONCLUSION AND SUGGESTION**

The data on students’ ability in making student worksheet shows that there are some important aspects of making student worksheet that needs to be improved before students are finally able to make appropriate scientific-project-based worksheet. In addition, because the project is still in its development stage, it is recommended to test the developed model on limited scope with valid instrument in assessing students’ ability. Hence, detail information on the strength and the weaknesses of the model could be obtained.

**REFERENCES**


Developing Environmental Biology Cognitive Instrument for High School Student

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Abstract

This study aimed to develop a valid and reliable instrument to be used for measuring high school students’ cognitive about environmental biology. A six-step model was used in the development of instrument adoption of Ugulu et al. (2013). These stages are development of item pool, validation of item pool, taking expert opinions, pilot testing, administration of the instrument, and calculating validity and reliability of instrument. This instrument was developed on three cognitive dimensions and on six cognitive process dimensions adapted from Taxonomy Bloom Revision. Items on instrument consist of multiple choice and essay. Validation stage was submitted to one environmental expert, one pedagogic expert, two high school biology teachers, and two faculty members. The pilot testing of instrument has been carried out with a group of 30 students. Widely pilot testing involves 60 students. Results of this study show that twenty two items fit to use for measuring high school students’ environmental biology cognitive.

INTRODUCTION

Global environmental crisis is happen remember the present time included damage (forests, land, the ozone layer), pollution (water, soil, air), the extinction of energy resources and minerals, biodiversity loss, global climate change, and others. Where the global environmental crisis is already a very serious threat to human life and real. According to Sony Keraf, former Environment Minister, who was invited as a speaker at Rapat Teknis Pengendalian Kerusakan Lingkungan Hidup held by Kementerian Lingkungan Hidup Pusat Pengelolaan Ekorregion Jawa, quoted from the web UIICenter for Environmental Studies, found the root causes of global environmental crisis, among others, is a mistake in perspective (paradigm) of man against himself, nature, and man’s relationship with nature. To overcome these problems, according to Sony Keraf, it is necessary to act so that the environmental crisis can be resolved.

Ashari, 2012 state that cognitive ability of environmental biology related to environmental attitude. In senior high school in Indonesia, environmental biology is not a major. But, cognitive ability of environmental biology is important to know. So that, this research is proposed to develop a valid and reliable instrument to be used for measuring senior high school students’ cognitive about environmental biology.

METHODS

Sample

The target population of this study is students of class X because they have learned about environment in this semester and they also have learned Environmental Education subject. Purposive sampling was used to select sample. Sixty students have chosen from one of Senior High School in Bandung, West Java, Indonesia.
Stages in Development of the Environmental Biology Cognitive Instrument

The stages from this study, adapted from Ugulu et al (2013), displayed in Fig.1.

FIGURE 1. Development process of environmental biology cognitive instrument adapted from Ugulu et al (2013)

RESULTS

Stage 1: Development of Item Pool
Before building up the item pool, an analysis curriculum 2013 and environmental education objective was done. The result of the analysis is determined the dimensions of instrument. The dimensions are biodiversity, water, soil & land, air, energy, waste, and human. Biodiversity covered function of biodiversity in nature, interaction between human and biodiversity, and biodiversity conservation. Dimension of water, soil & land, air, and energy covered function of water, soil & land, air, and energy in nature; interaction between human and water, soil & land, air, and energy; energy crisis; water, soil & land, air contamination; and water, soil & land, air, and energy conservation. Dimension of waste covered waste tackling and waste preventing. The last dimension is human dimension. Human dimension covered human population change and increasing human quality life. Then, the items developing considered cognitive dimensions and cognitive process dimensions. The items developed in 2 kind of item type, multiple choice and essay. As a result, an item pool consisting of 36 items has been developed.

Stage 2: Validation of Item Pool
Draft item were sent to two specialists, a environmental content specialist and a pedagogical specialist, for formal review. Each item was placed into a matrix and then asked to be evaluated in content validity, clarity and understandability, and accuracy. Based on expert thoughts on the list of items and examining of existing scale, some items were revised.

Stage 3: Taking Expert Opinion
The experts consist of two senior high school teachers and two graduate student were majoring in biology education. The expert were then asked to examine the items with regard to their relevance to the purpose of the instrument, content coverage, understandability and consistency. Revisions were conducted in accordance with opinions and suggestions of the expert. Finally, 36 revised items can be used in the pilot project.

Stage 4: Pilot Testing

Bandung, October 17th, 2015
The pilot testing have been carried out with a group of 30, 10th grade students attending high school in Bandung, West Java, Indonesia. During the administration, students were asked to mark the items which were ambiguous or confusing, difficult to understand, and were asked to answer all the question to see compatibility answers with the questions. These items were worked on and revised after pilot test. Final items were 22 items consist of 20 multiple choice and 2 essay.

**Stage 5 : Administration of the Instrument**

Final form of 22 item environmental biology cognitive instrument was administered to 60 10th grade students in senior high school in Bandung on even semester of 2014/2015.

**Stage 6 : Calculating Validity and Reliability**

Validity is about measuring the concept, desire to measure, without confusing it with others concepts. Arranging this instrument according to construct validity that indicates how accurate it measure an abstract concept to be measure. In the development process of the instrument, the expert opinions provided data about content and face validity, and students’ evaluations provided data about construct validity. Reliability is about how consistent the items are with each other, in a questioner and shows to what extent instrument reflects the data about the concept. In our study, for determining whether items of the instrument are consistent with each other or not, frequently used Cronbach alpha internal consistency coefficient was calculated.

The data collected from 60 senior high school students were analyzed by SPSS (Statistical Package for the Social Sciences) version 19. Total Cronbach alpha all items is 0.645. Liu (2003) in Ugulu et al (2013) argues that for pilot testing, alpha can be taken as 0.60.

**CONCLUSION**

Constructing a cognitive instrument of environmental biology which should be used to measure levels of senior high school students toward environmental biology contents. To develop a qualified instrument, all step adapted from Ugulu et al (2013). The draft scale was composed of 36 items consists of multiple choice and essay. After the process of development and revision of the pilot test, 22 items appeared to be functioning to discriminate among various levels of environmental biology cognitive. The validity of instrument was also supported by result of the construct validity test by 6 experts (2 professors, 2 biology teachers, and 2 graduate students who were majoring in biology education. The reliability coefficients of the instrument were 0.645. Therefore, these results support the expectation that the environmental biology cognitive instrument is a reliable instrument for measuring students’ level of environmental biology cognitive.

**ACKNOWLEDGMENTS**

The authors would like to thank Dian Anggraini and Tuti Garnasih for their assistance with data management, and we are so grateful to the schools, students, and teachers who made possible to collect the data.

**REFERENCES**

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Nurturing and Assessing Critical Thinking Through Student’s Journal

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Article info

Abstract

Keywords:

Teacher candidates are facing complex challenges skills needed in a globalized 21st century, which are commonly known as the 21st skills. One of the skills is critical thinking. To nurture students of Biology Teacher Training Program of Sebelas Maret University to get accustomed with critical thinking process, student’s journal had been offered as portfolio assessment in the course Learner Development. Twenty-two students had been purposively selected as participants. Research was conducted as four-cycles action research, held in 2nd semester of academic year 2014/2015. Student’s journal had been routinely made by student to note all concepts they learnt, unknown concepts, and method to clarify the concepts, and student’s reflection. Student’s journal was assessed, and at the end of each cycle, critical thinking was tested to students, and all data was analyzed descriptively. The result of the research showed that the average of students’ cognitive test increased from first cycle to the four, i.e. 78, 80.3, 84.2, and 87.3, respectively. However, the quality of student’s journal had not followed the same pattern of student achievement, particularly at the two last cycles. It is probably because the journal was not included in determining student’s final score. This was negatively impacted student’s motivation at the end of the course. Based on the results, student’s journal can be recommended as one of ways to improve critical thinking of student, and it should be involved as portfolio assessment.

INTRODUCTION

Critical thinking (CT) is becoming a big issue and challenging among educators and scholars who work to enhance what commonly popular as the 21st skills. The issue of CT in Indonesia is quite new, particularly in higher education, where lectures are mostly delivered knowledge expository, and traditionally aims to transfer the knowledge solely. It is being argued recently, whether do we really need to teach critical thinking as a subject or we just believed that what lecturers have done routinely at the classroom has already reflected the critical thinking process, though the students are prominently be quiet during the class. In other words, do critical thinking equals to a very argumentative or talkative student during the learning process, or it is symbolized on how they accomplished a sort of paper test at the end of the course? On this level, we still argue do we need to change our traditional teaching instruction and assessment as well.

Why graduates of higher education need to be critical thinker? Global scholars argue that graduates of higher education are facing the era of globalization, in which complex socio-science problems occur daily, and need to be anticipated critically. Those problems are caused by various factors, which also non-structurally formed. Nowadays human problems cannot be answered simply in only one correct solution. Problems in current situation are formed in random sequence from a number of small problems; sometimes
duplicated by similar or different problems; hence it should be parsed to track the original root of the problem. Thinking deeply and analytically is required to come out with best decision to solve those kinds of problem. However, this argument also bring us to the next critical question, i.e. do we need a skill of thinking or we require blended knowledge to solve those complex problems? Even in America where the critical thinking was firstly recommended as important point as educational goals, scholars still debate the critical thinking issues. A very new article of The Newsweek (released on 14 August 2015) is questioning this matter.

To nurture CT, teaching at higher education needs an appropriate instructional method. Valid assessment as well will be a recommended action to improve CT of higher education (Verburgh, et al., 2013). Typical teaching places lecturer as the only knowledge sources, and as the impact, time is mostly allocated to listen explanation of the lecturer. Students spend less even no time to discuss and explore what they knew. In Indonesia, one hour class equals to fifty minutes lecturing which can be divided into three parts, i.e. opening, core of the lecture, and closing. At the opening part, lecturer usually explains the purpose of the learning, and at the core part, lecturer spend mostly time to explain the content by mainly presenting the PPT slides, and finally closed to the last five minutes with a sort Q&A session.

Traditional teaching is also followed by traditional assessment. In Department of Biology Education Faculty of Teacher Training and Education Sebelas Maret University, achievement of students was assessed four times in one semester, before the new system of examination are applied currently, i.e. middle and final exam. Under the former four-system, each examination will test one main topic, which was delivered in three meetings. Tests are mainly a Multiple Choice Question (MCQ) or essay.

In this research, we assumed that teaching instruction and assessment could shape students culture on thinking process. Hence we applied a student-oriented lecture by setting more discussion time for students, and reducing time for lecturer to transfer the knowledge content. Teaching and learning was implemented using three types of method or model, i.e. 1) explanation followed by group discussion, 2) group investigation through literature analysis, and 3) project-based learning. To support the strategy, lecturer introduced some titles of reference books, articles, and online sources. And for doing a project-based activity, lecturer also offered to students some schools as places to do investigation. Critical thinking of student was nurtured through Student Journal, and its content was analyzed to know how student develop their critical thinking skills. Moreover, a sort of cognitive-based test was also measured at the end of each cycle.

The Concept of Critical Thinking

Critical thinking as an issue in education today is actually an old issue, which had been introduced since John Dewey on How We Think, and also in the most often cited reference on the cognitive process and domain of knowledge, introduced by Bloom in his taxonomy (1956). Scholars around the universal have shared abundant definitions from various points of view. Huitt (1998) had collected some definitions of CT in the era 80’s to 90’s. He categorized the contribution of those definitions from the view of cognitive psychologist, such as Paul Chance and Richard Meyer, which distinguish CT and creative thinking by definitely elaborate the operation and process involved in CT process; from the area of philosophy such as Richard Paul, CT is a process of thinking to a standard, i.e. thinking should build our beliefs and impact to our behaviors; and from the content specialist, such as Hickey and Mertes, CT can be learned from many subjects, not as exclusively as a set of skills. Huitt finally comes out with his own definition, i.e. CT is...
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“the disciplined mental activity of evaluating arguments or propositions and making judgments that can guide the development of beliefs and taking action”.

Emily R. Lai (2011) did a review of critical thinking literatures, and she focused on investigating how scholars define the CT, and how CT has been developed as a concept and practical skill. She traced the definition from three points of view, i.e. philosophy, psychology, and educational approach. Her review is in some parts similar with Huitt’s work, but she writes more recent literatures. Some 21st definitions of CT that Lai mentioned are Bailin (2002): “critical thinking as thinking of particular quality-essential good thinking that meets specified criteria or standards of adequacy and accuracy”; Facione (2000): “judging in a reflective way what to do or what to believe”; Willigham (2007): “seeing both sides of an issue, being open to new evidence, that disconfirms your ideas, reasoning dispassionately, demanding that claims be backed by evidence, deducing and inferring conclusions from available facts, solving problems, and so forth”.

The Partnership for the 21st Century Skills (2009) put CT as learning and innovation skills of 21st century, parallel with Problem Solving skills. Its definition is a sort of skills includes reasoning effectively, using systems thinking, making judgments and decision, and finally solving problems.

How to Assess Critical Thinking

Ennis (1993) had discussed the Assessment of Critical Thinking in his paper. He confirmed that to select, criticize, or even develop an assessment for critical thinking, we have to consider the definition of CT. Bissell and Lemons (2007) stated the same opinion, that there are two major impediments to develop critical thinking in the classroom, one of them is the lack of understanding what critical thinking means. In some cases, teachers realize that critical thinking is an important skill that they have to teach the students to acquire it. In contrast, only a few teachers understand what critical thinking is (Paul., et.al., 1997). According to Ennis, person can be judged as a critical thinker if he is able to judge the credibility of sources; identify conclusions, reasons, and assumptions; judge the quality of an argument, including the acceptability of its reasons, assumptions, and evidence; develop and defend a position on an issue; ask appropriate clarifying questions; plan experiments and judge experimental designs; define terms in a way appropriate for the context; be open-minded; try to be well informed; draw conclusions when warranted, but with caution.

Assessment for critical thinking is not only a method to measure the level of individual skills, but the most important aim is to improve learning process individually or in a group. Furthermore, Ennis (1993) comes with some alternative purposes of CT’s assessment, i.e. diagnosing the level of students’ CT; giving students feedback about their CT prowess; motivating students to be better a critical thinking; informing teachers about the success of their efforts to teach students to think critically; doing research about critical thinking instructional questions and issues; providing help in deciding whether a student should enter an educational program.

Previous works on designing assessment of CT had been done by some scholars using the Bloom Taxonomy of cognitive domain, such as Bissell and Lemons (2007). The revised Bloom taxonomy which was proposed by Anderson and Krathwohl (2001).

EXPERIMENTAL METHODS

Twenty two-freshmen of Biology Teacher Training Program, who took one of the compulsory lectures offered at second semester, namely “Learner Development” were selected purposively as respondents of the research. Learner Development provides teacher candidates with some knowledge on psychology development of students, which are the
fundamental information for teacher on how to deliver learning, and manage the problems from the classroom based on the students’ development. The course consisted of 16 meetings, which was divided into four main topics, and at the end of each topic, there was a cognitive test, which was mostly an essay test. Learning and instructional methods were expository, group discussion, and at the last four meetings, a project based-learning had been employed. At the first topic, students learnt about the fundamental concepts and theory on learner development, from biological and physiological aspects. The second main topic was tasking for learner, in which students studied on how to provide learners with the appropriate tasks based-on their physics, emotional, social, and cognitive development. The third topic was analyzing the cognitive, psychomotor, emotional, social and spiritual development of learners.. And at the last main topic, students do the project on high school students’ problems.

The research was an action classroom research with four cycles. The given four main topics was becoming the topic of each cycle. To nurture the CT skills of students, a student journal (SJ) was introduced at the first meeting. The journal was submitted by email with the deadline three days after the meeting. The content of journal was focused on the concepts that student has already known, the unknown or understandable concepts, the steps on how to investigate the unknown concepts, and self-reflection of student. The number of SJ pages was unlimited, but student had to write at least two pages. Rubric of performance assessment of SJ was developed based on six predominant criteria: 1) a completeness of SJ (should consist the given parts); 2) Clarifying the understandable concepts (should clear on stating or claiming, and argumentative explanation of the concepts, mapping the concepts, correct citation); 3) Clarifying the unknown concepts (stating or claiming the concepts, argumentative explanation, related to the topic); 4) Method of investigation (clearly mention the elements of the concept as keywords to discover the correct concept, way or method to look for the concept, and the related references); 5) Result of Investigation (claiming the new concepts, argumentatively describe the concepts, mapping the new concepts, using the standard words, and correct citation); and 6) Self-reflection (stating a self-reflection clearly, evaluating learning process, time effectiveness, and stating next plan or commitment). The performance of SJ was scored 1 to 4 of one criterion, and finally the total score of student had been summed and compared. The total of SJ submitted was 9 journals per student, and after reducing the no appropriate data, four journals were selected as samples for SJ analysis, i.e. SJ 1, SJ 4, SJ 7, and SJ 9, which represent a four cycles of action research.

To assess the CT skills of students, a cognitive test had been delivered in the last meeting of each cycle. The test was to assess student’s abilities to apply the known concepts on some contextual problems, which teacher mostly facing in the classroom. The number of main questions in each test was three questions, which were sub divided into two or three sub questions. Those sub questions were to trace and nurture student’s ability to critically developed one concept. All data were descriptively analyzed.

RESULTS AND DISCUSSION

Student journal was examined based on the given rubric, and the score of each component of SJ was summed to obtain the total score of student’s performance on writing the SJ (TABLE 1). At the first cycle, the score of SJ was ranged from 45.83 to 88.33, and at the second cycle, the highest score was 79.17, and the lowest was 45.83. Although, the mean of SJ at this cycle increased slightly compare to cycle 1, the highest score decreased, and the number of students in the low category was higher than previous cycle. At the third cycle, the average of students’ performance was lower than two former cycles. And at the
last cycle, the average of SJ score was 61.17 or increased 5.11 points. Detailed of student’s score on SJ is figured out on Fig. 1. If students’ scores were divided into two categories (low and high), the number of students who have a low performance on SJ (score below 67) at the first and second cycle was 10 students. However, this number doubled at the third cycle, and turn down into 12 students at fourth cycle.

If we do mapping of student performance on each cycle, we can notice that there are some students permanently showed low performance on SJ at all cycles, i.e. student number 1, 13, 15 and 20. Moreover, student number 4, 5, and 14 seems to be put in low categories, since they were counted as low in three cycles. On the contrary, student number 6 and 17 were persistently showed the increase of SJ score (Fig.1).

**TABLE 1. Description of Student Journal of each cycle**

<table>
<thead>
<tr>
<th>Component</th>
<th>Cycle 1</th>
<th>Cycle 2</th>
<th>Cycle 3</th>
<th>Cycle 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Score</td>
<td>88.33</td>
<td>79.17</td>
<td>75.00</td>
<td>79.17</td>
</tr>
<tr>
<td>Minimum Score</td>
<td>45.83</td>
<td>45.83</td>
<td>33.33</td>
<td>45.83</td>
</tr>
<tr>
<td>Mean</td>
<td>63.86</td>
<td>64.58</td>
<td>56.06</td>
<td>61.17</td>
</tr>
<tr>
<td>Freq. of Low Category (Student No.)</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>(1, 16, 19, 12, 13, 14, 15, 16, 17, 20)</td>
<td>(1, 4, 5, 7, 8, 11, 13, 15, 18, 20)</td>
<td>(1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 19, 20, 22)</td>
<td></td>
</tr>
<tr>
<td>Freq. of High Category (Student No.)</td>
<td>12</td>
<td>12</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(2, 3, 4, 5, 7, 8, 9, 10, 11, 18, 19, 21, 22)</td>
<td>(2, 3, 6, 9, 10, 12, 14, 16, 17, 19, 21, 22)</td>
<td>(6, 7, 8, 9, 10, 11, 16, 17, 18, 21)</td>
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</tbody>
</table>

Student Journal tended to be less effective at the last two cycles, drastically showed a very low performance at cycle 3, when students made a journal about language and cognitive development of learner. Learner’s cognitive development and also the language ability of learner seem uneasy to be understood by students. It is probably because the topic covers wide area of knowledge, and a lot of theories stated by psychologist from many years ago. Most students made a claim without evidence, and simply copied the content of related textbooks. In other world, it can be said that students did not follow a critical thinking process to construct the new concepts.
On the other side, the students showed a positive performance in the result of cognitive test in each cycle. Students’ performance on cognitive test was figured out at the Table 2 and Fig.2. Maximum score of students changed positively from cycle to cycle, and the minimum score was also significantly increased. The average of cognitive test score showed the parallel performance. Moreover, the number of students who got score below 80 gradually turn down, and finally no student had placed this category at the last cycle.

According to Fig.2, we can notice that more than 50% of students showed a significant good performance in each cycle, and the score were gradually up from the lowest 71 to 85 at the fourth cycle. Only one student performed below 70 at the second cycle, i.e. student number 12. Cognitive test was developed based on contextual problems that commonly happened inside the classroom or at school. The increasing of students’ score in each cycle probably indicates positive improvement of critical thinking skills of students.
FIGURE 2. Student’s performance on Cognitive Test: (a) first cycle, (b) second cycle, (c) third cycle, (d) fourth cycle

The nurturing process through SJ was argued impact the critical thinking skills of students, which can be noticed from the result of cognitive test. Hence, the trend of SJ score and cognitive score should be parallel or linear. In other words, it can be claimed that nurturing process will significantly influence the cognitive test, if we set a nurturing process as a treatment. However, in this research, a contradicted trend on the impact of nurturing process through SJ and assessing process through cognitive test had been indicated.

Assigning the SJ to students nine times or more than half of semester meetings seems to be a burden for students. Routinely asked them to note and do concept construction had not bring them to be more critical, but as for accomplishing the SJ, students did more copy and paste activities. It can be argued that routine task will not work well, if there are no variations on types of task. Moreover, students in Indonesia are always facing task as an examination, which will be examined and scored by teachers after the accomplishment. They often asked for the exact score, rather than reading or listening the explanation of what they have achieved and what they have to train more. In this research, students did not get the SJ score as additional point to their final score of all exams. For that reasons, students probably did not count the important of SJ as to nurture the critical thinking skills.

The SJ as a regular activity of student should be assigned in sufficient frequency, in order to not incriminate students. This task should also be managed in various kinds of work that will done by student individually or collaboratively. Moreover, the progress of SJ have to be informed to the students which will definitely influence student’s learning process.

CONCLUSION

A strategy to nurture the critical thinking of student through the Student Journal had impacted the critical thinking of students which can be convicted through the increasing of cognitive test score from the first cycle to the last cycle. The student performance on cognitive test had increased effectively. However, the quality of SJ that students developed was not parallel with the increasing of cognitive test.

Nurturing students to think critically can be proceeded through the student journal activity. However, a high frequency of SJ activities will be an impediment to teach critical
thinking in the classroom. Hence, nurturing process should be set as a systematic task for students, and it should be followed by the sort of cognitive test for assessing the critical thinking skills of student. The content of the test should deal with the critical thinking process which have been trained through the student journal.

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The Analysis Of Critical Thinking Skill Students In Science Lessons

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Article info

Keywords:
higher order thinking skill, critical thinking, science, gender

Abstract

To Improving the quality of science education was done through thinking of science and development thinking science, because it can to increase high order thinking skills students. The Critical thinking is one of part high order thinking skills; the critical thinking is meant corrected thinking in search for relevant and reliable knowledge about the world of reality. The Critical thinking is a mental activity in terms of problem solving, making decisions, analyzing assumptions, evaluating, giving rational, and conducts an investigation. The Critical thinking meant as correct thinking in the search for relevant and reliable knowledge about the world of reality because one of the goals of learning critical thinking in the teaching of science is to improve students thinking skills and also prepare students to face the challenges of everyday life. This research was focused to analysis of critical thinking skills students in junior high school. The participant are students of the junior school (N=80). Data was collected using critical thinking test which consists of eight questions. The Result of analysis shown the percentage of critical thinking skills in each indicator are: 1) Elementary clarification 62%; 2) Basic support 43.5%; 3) Inference 43.8%; 4) strategies and tactic 13%; 5) a further explanation of 20.6%. If refer to frombased on gender, male and female student have almost same score in each indicator, Mean of critical thinking skills in each indicator for male student are: (1) Elementary clarification 1.5; (2) Basic support 0.9; (3) Inference 1.1; (4) strategies and tactic 0.4; (5) a further explanation 0.5., and female student are: 1) Elementary clarification 1.5 ; (2) Basic support 1.1 ; (3) Inference 0.9; (4) strategies and tactic 0.2; (5) a further explanation 0.5., it’s meant both can answers the question critical thinking in science lessons.

INTRODUCTION

The current curriculum requires developing higher order thinking skills students. Higher order thinking skills is a cognitive operation that is much needed in the thinking processes that occur in the short-term memory. Higher Order Thinking Skills defined including critical thinking, logical thinking, reflective, metacognition and creative (King., et. al., 2011). All these skills will be active when a person is faced with an unusual problem, uncertainty, questions and choices. Costa (1985) stated that there are four groups of higher order thinking skills processes such as: problem solving, decision making, critical thinking, and creative thinking.

Teaching higher order thinking skills is one of the objectives in all levels of education as junior high school, senior high school and the university. In fact, several of junior high schools in Lombok Timur, rarely to train of higher order thinking skills; the assumption is teachers have not known the technique to teach that ability. Tests given still limited in the low cognitive level and students disposed less actively engaged in learning process that involves the ability to think, students are listening to the explanation of the teacher. That condition causes the achievement of learning outcomes still low, especially
the cognitive learning. According Mahanal & Zubaidah (2009: 48), the learning process each level in education should focused on developing student’s critical thinking.

The results of Computer Technology Research (CTR) showed the person only remember 20% what he had seen 30% of hearing, 50% both are heard and seen, and 80% is heard, seen and doing simultaneously (Raniawaty, 2011). In addition, Levi and Levi (Arzad, 2009) conclude that the visual stimulus produced better learning outcomes for tasks such as remembering, recognizing, recalling, and the connection between the facts and concepts. Meanwhile, the stimulus verbal give better learning outcomes when the learning involves sequentially memory.

Natural Sciences is one of the subjects at the junior school level, the concept about natural and have a relationship is very widely associated with human real life. Natural Sciences as knowledge gained through data collection with experimentation, observation and deduction to produce an explanation of symptoms that can be trusted. Natural Sciences developed as an integrative science subjects rather than as disciplines educational, applicative oriented, the development of thinking skills, ability to learn, curiosity, and the development of caring and responsible attitude towards the social and natural environment. Natural Sciences also devoted to introduction of biology environmental, natural surroundings and introduction a variety advantages over the archipelago (Kemdikbud, 2013).

The establishment of the conceptual system in Natural Sciences, a higher order thinking skills processes commonly used is critical thinking. In this case, it is necessary to have the society who understand the concept and the principles of science, who live harmonically with the nature, who recognize the variety of the nature, who apply the knowledge and the way of thinking on science for the social and individual purpose, and who give a priority to the science competency which is needed by all members of society in order that it is beneficial to cope the problems in daily lives (Rutherford & Ahlgren, 1990). In teach science concept, teachers rarely apply to training students’ of higher order thinking skills especially critical thinking skills, whereas critical thinking can be applied in the contextual content, and form assessment used still a classic type that is multiple choice questions and essay type more require student's ability to memorize and remembering. Based on described in background, the question of research is whether students can be critical thinking using essay questions on science subjects?

**EXPERIMENTAL METHODS**

This research used by descriptive statistics that is described toward researched object through the sample data or population without analysis and making a conclusion generally (Sugiyono, 2011). The participant is junior high school student (N=80). To assessment critical thinking skills students' used the form essay questions with referable of critical thinking skills indicator stated by Ennis i.e., 1) Elementary clarification; 2) Basic support; 3) Inference; 4) Strategies and tactic; and 5) a further explanation (Komalasari, 2011). Analysis data by calculating percentage and mean for each critical thinking skills indicator.

**RESULTS AND DISCUSSION**

A learning activities in Natural Sciences include develop skills to asking questions, to finding answers, to understand answers, to complete answers about "what", "why" and "how" of natural phenomena and characteristics in their around through systematically
many ways will be applied in the environment and technology. Three ability in Natural Sciences that are: (1) ability to know what observed, (2) ability to predictions what has not been observed, and to examine the follow-up results of the experiment, and (3) development of a scientific attitude. Critical thinking has impact for student to analyze and solve the information that founded. Here are the results of critical thinking skills students' be presented in form chart (see Figure 1).

![Figure 1. Percentage and Mean of Critical Thinking Skills Student](image)

The question about concept of science (global warming content) was given to junior high school students (grade 7), the question referable of critical thinking skills indicator. Based on analysis data, it appears that the indicator Elementary clarification get more percentage (62%) compared with other indicators, this causes because the questions is require answers by stated the simple reason based on theory their obtained, as an example the question "Why deforestation can be one of the causes of global warming" and the answer have in their book. According Zubaidah (Mahanal, 2009), the better quality of the questions asked it is increasingly clear show used good reasoning. However, the use of language teachers in accordance with the age of students is an important consideration in teaching (Dahar, 2006).

In this research, researcher try to expressed different thinking skills of male and female students, and the result is almost in each indicator have same a result, just different two point (male 4.4 and female student 4.2). A details of result in each indicator if see from averagely: for male student are: (1) Elementary clarification 1.5; (2) Basic support 0.9; (3) Inference 1.1; (4) strategies and tactic 0.4; (5) a further explanation 0.5. and Female student are: (1) Elementary clarification 1.5; (2) Basic support 1.1; (3) Inference 0.9; (4) strategies and tactic 0.2; (5) a further explanation 0.5. (see Figure 2). Facione (Quitadamo and Kurzt, 2007) stated that critical thinking is a process in assessing self-regulation, solve the problems, and make decisions. Critical thinking is a destination, the process of self-regulation that provides a mechanism to solve problems and make decisions based on logical reasoning which is very useful in solving national and global issues. The critical thinking skills is examining, connecting and evaluating aspects on the problem, collected.
and organized information, validating and analyzing information. Included also remember and associate information previously learned, determine a rational answer, described valid conclusions, analysis and reflection. Ennis (Marzano, 1988) stated, critical thinking as a reasonable reflective thinking focused on the decision to be sure and do that is a form of creative action.

![Figure 2. Mean of Critical Thinking Skills Based On Gender](image)

Science learning has a role to arouse interest someone to understand about universe and can be applied in real life. One of basic assumptions in standardization in science education is the learning of science tended of learners needed, involved in the learning process and being able to learn science (NRC, 1996). By learning science, students can logically thinking and training the higher order thinking skills. The Science education can help learners to develop an understanding and habits of thinking for himself and his nation (Liliasari, 2011). According Presseisen (Costa, 1985) thinking is a process of mental activity an individual to get knowledge. This process is a conscious cognitive activity and pursued resulting in the acquisition of meaningful knowledge. Costa added that thinking is receiving external stimuli through the senses and internally processed, if the information is saved, the brain will paired, compared it, categorized, and shaped be the same information that has been saved.
CONCLUSION

A students in junior high school grade 7 can critical thinking in science lessons, and male and female student too. The form question to measure higher order thinking skills students especially critical thinking is essay type and contextual content. Learning science helps students to logically thinking and training higher order thinking skills especially critical thinking skills. The percentage critical thinking skills students' in science lesson for each indicator are: 1) Elementary clarification 62%; 2) Basic support 43.5%; 3) Inference 43.8%; 4) strategies and tactic 13%; 5) a further explanation 20.6%. Mean of critical thinking skills in each indicator for male and female students: a) male student are: (1) Elementary clarification 1.5; (2) Basic support 0.9; (3) Inference 1.1; (4) strategies and tactic 0.4; (5) a further explanation 0.5. And (b) Female student are: 1) Elementary clarification 1.5; (2) Basic support 1.1; (3) Inference 0.9; (4) strategies and tactic 0.2; (5) a further explanation 0.5.

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Implementation of Science Process Skill Based Instruction on Biodiversity Using Local Potency to Improve Classification Ability of Junior High School Students

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Article info

Abstract

A study about biodiversity instruction using science process skill approach was conducted to investigate/analyze the improvement of students’ classification ability after the implementation of science process skills approach with emphasize on classificatory process and empowering local potency in biodiversity instruction. Weak experiment method with one group pretest-posttest research design was used with the involvement of a number of seven graders (n=32). The study was carried out at one state Junior High School in West Bandung District using Test of Classification Ability of Biodiversity (TOCAB), observation guides and interview as instruments. Data analyses used are the results of pretest, post-test and n-gain, as well as hypothesis testing. Research findings show that: (1) science process skills approach using local potency can improve classification ability of Junior High School in medium average category (69%); (2) the highest classification ability is shown by naming of group in high category of achievement (85%), whereas the lowest classification ability is arrange horizontal classification (53%); (3) there is no significant differences in the increasing of classification ability based on gender, but the girls have higher performance in large measure of classification ability; (4) nearly all the students had joyful learning with science process skill approach using local potency and positive response from the teachers. It comes to the conclusion that science process skill approach using local potency can be used as an alternative strategy to improve classification ability of Junior High School students.

INTRODUCTION

Science is a process, product, and value. As stated by Abrucasto (1982), science is a group of processes that systematically collect information on the nature; science is also the knowledge gathered through the use of the process; science is also classed as values and attitudes are influenced by people who use scientific processes to seek knowledge. Teaching science to students in accordance with nature of science would require a special approach.

One science learning concepts presented in the Junior High School is the concept of biodiversity. This concept is very interesting, the media are very much in the form of original objects, as well as the knowledge of the traditional classification by society has existed, although unconsciously. Unfortunately, biology student learning outcomes, particularly in the concept of biodiversity and classification are not satisfactory, due to the tendency of rote learning that is oriented products (concepts, theories), and less attention to the level of intellectual development of students (Rustaman, 2010). Additionally during the
biodiversity instruction have a tendency teacher presents examples from just the textbooks (Nuraeni, 2012). This resulted in less meaningful learning and develop students' reasoning.

One measure of student learning meaningfulness is the achievement of basic competence (BC) as specified in the contents standard of curriculum. In the content standards of Education Unit Level Curriculum (EULC), the concept of biodiversity is a part of science subjects to the standard of competence (SC) to understand the biodiversity and the BC is to classify biodiversity based on the characteristics of its (Depdiknas, 2006). If we consider the formulation of BC so the minimum competency main expected is skill classification process through the concept of biodiversity. In other words the minimum of ability expected after learning that students have the classification ability of biodiversity, not the ability to memorize a concept that is so.

Classification ability is the ability to perform a classification that includes ability to find differences and similarities characteristic, contrasting characteristics, determine the basic grouping, classifying objects based on observable traits, giving the name of the group, determine alternative grouping based on the criteria of students, horizontal classification ability (binary), and the vertical classification (multilevel). Learning the classification to the students is important to do because the classification including the process of thinking that very important. Classification can improve the logical thinking ability (Rustaman, 1990), critical thinking and flexible thinking (Rustaman, 2010). Learning classification is also important for students because in addition to helping students make inferences, the classification process allows them to appreciate how the current classification system be there (Settlage & Southerland, 2007).

The ability of the classification of each person is different by level of intellectual development. Based on the classification level of intellectual development raised by Piaget (Dahar, 1996; Krause, 2007; Garber, 2010; Kuswana, 2011; Setiono, 2008), the students of Junior High Schools is estimated to be on stage think concretely towards formal thinking. According Setiono (2008) on the stage of concrete operations child can think of systematic and logical but limited to the object that is the concrete activity. Teachers should be aware of the level of intellectual development of students and learning design in accordance with the level of intellectual development of students, in order to equip students to make the right decisions to solve problems efficiently (Abdullah and Sharif, 2008), as well as provide minimal competence in accordance with BC. Learning in accordance with the level of development at this level is to present concrete direct experience and concrete problems in accordance with the minimum competency that will be procured, in this case the classification ability of biodiversity.

Science Process Skills Approach (SPSA) is the application of Process Skills Approach (PSA) in the learning of science. According Rustaman et al. (2005), such as SAPA (Science A Process Approach) SPSA is a learning-oriented approach to the process of science. However, in the purpose and implementation there is a difference. SAPA is not concerned with the concept. In addition SAPA requires the development of a process approach as a whole that is the scientific method in every implementation, whereas the types of skills in the SPA process can be developed separately, depending on the method used. One application of SPA that appropriate classification ability is to equip SPA approach that emphasizes the process of classification. SPSA that emphasizes active student classification process involves direct observation, looking for similarities and differences, determine the grouping criteria, grouping, naming the group, and contrast characteristics by using plants or animals found in the student environment as learning media. Students are trained in the classification is expected to improve the ability of the classification.
SPSA using local potency and consider the everyday contexts students become strategic choice in achieving the learning objectives of science. Local potency is a resource owned by each region to be utilized in certain activities (Sudjana, 2000). Further put forward that local potency is closely linked with environmental input into the educational component which has a contribution to support for the process of learning. Based on the above understanding, the local potency which is referred to in this research is a form of resource potential that exists around the students and schools that can be used to support learning in the school.

**RESEARCH METHODOLOGY**

Weak experiment methods with the one group pretest posttest design used in this study because it only uses one treatment group and control group, as well as granted them the pretest and posttest (Fraenkel & Wallen, 2007). Subject of research is one of the seventh grade at Junior High School in West Bandung District second semester of the 2012-2013 period as many as 32 students.

The instrument used in this study is Test of Classification Ability of Biodiversity (TOCAB), pieces of observation and interview guides. Data processing such as the calculation of the pretest, posttest, n-gain, the prerequisite test, and hypothesis testing. Calculation of normalized gain and the gain enhancement criteria are normalized using the formula of Hake (Meltzer, 2002). Kolmogorov-Smirnov test was used to test the normality of the data, Levene Test is used to test the homogeneity, Paired sample t-Test, Two Independent Sample Kolmogorov Smirnov, Kruskal Wallis test was used to test the hypothesis. All statistical tests are performed with SPSS 17 for Windows.

**RESULTS**

Based on the calculations, the information that an increase in the average score of the classification ability on pretests and posttest in order to obtain N-Gain 69% (medium category). More details can be seen in Table 1. Results of statistical analysis using *Paired sample t-test* values obtained sig 0.000 which indicates acceptance Ha, meaning that there is a significant difference between the average classification ability before and after learning, in other words, instructions with SPSA which utilize local potency significant effect on the classification ability of the student.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Upgrades Classification Ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Indicator</td>
</tr>
<tr>
<td>1</td>
<td>Finding the similarity</td>
</tr>
<tr>
<td>2</td>
<td>Finding the differences</td>
</tr>
<tr>
<td>3</td>
<td>Contrasting characteristics</td>
</tr>
<tr>
<td>4</td>
<td>Determining the basic groupings</td>
</tr>
<tr>
<td>5</td>
<td>Grouping based on predetermined criteria</td>
</tr>
<tr>
<td>6</td>
<td>Giving the name of the group</td>
</tr>
<tr>
<td>7</td>
<td>Creating an alternative grouping</td>
</tr>
<tr>
<td>8</td>
<td>Developing horizontal classification</td>
</tr>
<tr>
<td>9</td>
<td>Developing vertical classification</td>
</tr>
<tr>
<td>Average</td>
<td></td>
</tr>
</tbody>
</table>
Table 1 also shows that the ability of students based on indicators of the general classification ability increased after learning with SPSA using local potency when seen from a comparison of the average pretest and the average of the posttest on each indicator classification ability. Improving the ability of the best classification indicated by the indicator giving the name of the group with achieving an increase of 85% (high category), while the lowest increase (53%) indicated classifying horizontally indicators.

Comparison of upgrading the classification ability of students based on gender and age can be seen in Table 2 below.

**Table 2. Upgrades Classification ability Based on Gender and Age**

<table>
<thead>
<tr>
<th>No.</th>
<th>Indicator</th>
<th>Male students</th>
<th>Female Students</th>
<th>Age 12 Years</th>
<th>Age 13 Years</th>
<th>Age 14 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>NG (%)</td>
<td>Cat. (%)</td>
<td>NG (%)</td>
<td>Cat. (%)</td>
<td>NG (%)</td>
</tr>
<tr>
<td>1</td>
<td>Finding similarities</td>
<td>80 High</td>
<td>80 High</td>
<td>88 High</td>
<td>79 High</td>
<td>77 High</td>
</tr>
<tr>
<td>2</td>
<td>Finding differences</td>
<td>59 Medium</td>
<td>52 Medium</td>
<td>65 Medium</td>
<td>53 Medium</td>
<td>68 Medium</td>
</tr>
<tr>
<td>3</td>
<td>Contrasting characteristics</td>
<td>50 Medium</td>
<td>67 Medium</td>
<td>69 Medium</td>
<td>54 Medium</td>
<td>68 Medium</td>
</tr>
<tr>
<td>4</td>
<td>Determining the basic groupings</td>
<td>56 Medium</td>
<td>67 Medium</td>
<td>75 High</td>
<td>57 Medium</td>
<td>70 High</td>
</tr>
<tr>
<td>5</td>
<td>Grouping based on predetermined criteria</td>
<td>69 Medium</td>
<td>93 High</td>
<td>97 High</td>
<td>72 High</td>
<td>92 High</td>
</tr>
<tr>
<td>6</td>
<td>Giving the name of the group</td>
<td>81 High</td>
<td>92 High</td>
<td>94 High</td>
<td>84 High</td>
<td>94 High</td>
</tr>
<tr>
<td>7</td>
<td>Creating an alternative grouping</td>
<td>77 High</td>
<td>90 High</td>
<td>88 High</td>
<td>82 High</td>
<td>92 High</td>
</tr>
<tr>
<td>8</td>
<td>Developing horizontal classification</td>
<td>51 Medium</td>
<td>61 Medium</td>
<td>49 Medium</td>
<td>55 Medium</td>
<td>65 Medium</td>
</tr>
<tr>
<td>9</td>
<td>Developing vertical classification</td>
<td>65 Medium</td>
<td>69 Medium</td>
<td>62 Medium</td>
<td>68 Medium</td>
<td>64 Medium</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>65 Medium</td>
<td>75 High</td>
<td>76 High</td>
<td>67 Medium</td>
<td>77 High</td>
</tr>
</tbody>
</table>

Explanation: NG = N-Gain; Cat = Category.

Based on Table 2 can be seen that both male and female students has increased the classification ability after learning with different category level. Female students tend to show an increase in the classification ability higher than male students. Although the apparent difference, but based on testing with Kolmogorov Smirnov test obtained Asymp Sig value of 0.141 to 0.867 all of which are larger than 0.05 so that means there is no significant difference between the increase in each indicator of the classification ability of biodiversity both male and female students.

The data in Table 2 also shows that there is no clear pattern of improvement per indicator of the classification ability of the biodiversity based on age, but on a horizontal classification indicator that shows the pattern of an increasing trend by age. Kruskal Wallis test was obtained based on the value of sig of 0.144 sd 0.995, which means that there is no significant difference increase of classification abilities based on age.

Based on student interviews the results showed that students generally enjoy learning the biodiversity with SPSA using local potency, and teachers also give a positive response.

**DISCUSSION**

According to statistical analysis using Wilcoxon Matched Pairs Test turns there is a significant difference between the average classification ability before and after learning, in other words, instructions with SPSA which using local potency significantly influence the classification abilities of students'. Based on these findings it can be said that instructions with SPSA which using local potency can help students in improving the classification ability of biodiversity.

The increased of classification ability of students after learning with SPSA which using local potency can be understood because during the learning students are actively
involved both physically and mentally. Ginsburg & Opper (1969) and Setiono (2008) emphasized the need for activity, both physically and mentally. Piaget (Setiono, 2008) states that to know an object is to do something to the object. According Meichtry (Mabie & Baker, 1996) understanding of the students will be better if the hands-on activities and the provision of real experience applied to the students in learning. Furthermore Mabie & Baker (1996) states that the active participation of students in learning-oriented activities have a positive impact on the development of the science process skills. Dixson (2006) reported that learning with hands-on activity will enhance the science process skills. Learning with the SPSA which using local potency giving opportunities for students to gain real experience in the form of the classification process in living organisms that are around students. Mental activity were trained on students during a lesson with the SPSA which using local potency is the thinking of students in comparing the object observed, so that students can have the ability to find similarities, differences in characteristics, as well as indicators of the other classification ability.

Utilization of local objects facilitate students in recognizing objects to be classified as the object is an object that is close to life. Settlage & Southerland (2007) states that students must be given the opportunity to build their knowledge based on their personal experiences and connected with their daily lives. Further Settlage & Southerland suggests that learning begins with objects and actions that are already familiar and safe for students. Jegede (1999) states that the environment that is closest to the student plays a very important role in the learning, determining how the concepts learned and how they are stored in long term memory as schemata. Aikenhead (1997) states that if science is taught in schools in line with the daily life of students, the learning will have a tendency to reinforce the students’ views of nature. It is also through the use of local potency in learning biodiversity and their classification allows students to explore the ability to analyze natural phenomena associated with the biodiversity beings and their classification. As stated by Watson & Miller (2009) that the classification ability allows students to better understand some of the information and understand how to organize, compare and analyze information.

Using local potency in biodiversity and classification instructions also play a role in facilitating teaching seventh grade students who are still at the stage of intellectual development of concrete operations. According Setiono (2008) students at concrete operations of intellectual development stage need concrete media for observation. Concrete media that is easy to observe are plants and animals that are around students and is known by the students.

The highest increase of 85% achieved by the indicator giving the name of the group and the lowest by classifying horizontal indicator that is equal to 53% (medium category). This is in line with research Suharyani (2012) in which the indicator to name experienced the highest increase (93%). Students increased categorized as high (85%) on the naming of the group because the students have found a pattern of relationships between giving the name of a group on the basis of classification. While the developing of a horizontal classification, students have problems in the pouring written answer, in terms of describing the similarities, differences in characteristics, and contrast characteristics.

The findings which show that gender did not significantly affect the classification ability because both male and female students are given same treatment and opportunities for learning. The same way treatment contribute to the achievement commensurate increase in students with different gender. As stated by Hurlock (1992) that if given the same education and the same opportunity to use education, and given encouragement, women of all ages achieve the same tall success of men with comparable education and opportunity. An increase slightly higher in female students is due to emotional factors and
the use of the learning opportunities of female students better than male students. At the
time of student learning women appear to be more able to focus on activities and more can
work together during group work than male students. Focus on activities, as well as able to
work well together in a group including the part of self-regulation and social skills by
Goleman (1999a) is mentioned as a basic component of emotional intelligence. Further
Goleman (1999b) states without emotional intelligence, people will not be able to use their
cognitive abilities according to its maximum potential. Other factors that may also
influence the upgrading of the classification ability of female students than male students
is related to the temperament of the female students are more conscientious, diligent and
calm while learning than male students. As stated by Kartono (2006) that women are
generally more accurate and more detailed in the notice something than men. According
Muthaliin (2001) differences in temperament was due to differences between the
biological nature of men and women.

There is no significant difference the increase in the classification ability by age
indicates that in this study the age range of 12-14 years have the same relative
classification ability. However, if observed further, it can be seen that the age group 14
years higher than the age of 12 and 13 years old. The possibility of mental maturity at the
age of 14 years is better than 12 years old and 13 years old. Modgil (1974) and (Rustaman,
1990) states that mental maturation is the most decisive factor for the development of the
classification system. Other possibilities for the age group 14 years has more experience
than in the age group of 12 and 13 years, especially experiences relating to the
classification process. The discovery of an increasing trend pattern classification ability
horizontally based on age may be linked to students' experiences in daily life that relate to
horizontal in classification.

CONCLUSIONS AND SUGGESTIONS

Based on the results of this study concluded that the SPSA which using local
potency at the biodiversity instruction had significant effect on improving the classification
ability of Junior High School students.

Based on the conclusions that have been drawn up, the researchers gave the
following recommendations:
1. SPSA which using local potency at the biodiversity instruction can be an alternative to
improve the classification ability of Junior High School students.
2. The season can be an obstacle in object the provision of biodiversity to be observed.
Therefore, the selection of objects of observation can be done flexibly, or it helps in
the observation also assisted with photographs and preserved living thing so that the
data obtained students become more complete.

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Development of Anthropocentric, Biocentric, and Ecocentric In Elementary School, Junior High School, and Senior High School About Environmental Issues

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Keywords: informal reasoning, anthropocentric, biocentric, ecocentric, environmental issues

Abstract

This research is based on a theoretical foundation informal reasoning contain three types (from anthropocentric, biocentric and ecocentric). This study aimed to identify the development of student’s informal reasoning related to environmental issues ranging from Elementary School (ES), Junior High School (JHS) through Senior High School (SHS). This descriptive research involved 19 ES students, 33 JHS students and 33 SHS students in Bandung. These selected schools were managed by an educational institution including all three levels of education to avoid the factors which can influence person’s reasoning process. The data obtained through the open answer of essay question written test and interviews. The result shows that there is no clear development of student’s informal reasoning from anthropocentric reasoning towards ecocentric reasoning on ES through SHS. However, the pattern of informal reasoning at each education level was changed. The anthropocentric reasoning on ES through SHS students increased. Although biocentric reasoning on ES through SHS...
students is decreased. The ecocentric reasoning is not performed by ES students, precisely found the highest percentage is in the JHS students. Therefore, it can be concluded that the development of informal reasoning from anthropocentric to ecocentric from ES through SHS students is a reversed development.

INTRODUCTION

Basically a person makes a decision based on the reasons behind such a decision and that’s called person reasoning. The development of reasoning is influenced by several factors, both the persons’ internal factors and external environmental factors. However, aspects which are most likely to affect is school level where formal reasoning levels increased with increasing levels of education. The higher level of school, then the higher level of its formal reasoning. Except formal reasoning, as an educator needs to know the type of informal reasoning of students. Informal reasoning closely related to formal logic (tend to focus narrowly on the claim/ reason relationship) and arguments, so that informal reasoning is the main component of critical thinking. Dawson (2) mentions that informal reasoning using both cognitive and affective components appropriately when dealing with issues of socio-scientific reasoning therefore, often used informally during lessons at school. Informal reasoning in someone, like students can be categorized into several types of reasoning, one of is the moral reasoning of the environment. The need for educators to know the type of reasoning is because one of them can be used to customize the most appropriate learning method during the learning ecosystem (biological materials related to the environment) for the type of their moral reasoning. In addition, observe the moral education in the field of literature there are substantial someone to get better and evaluate the efforts made in teaching. The most important factor in building a moral education is that students can express their ideas which can be regarded as moral reasoning on the environment.

Moral reasoning on the environment that can be extracted from the students is the reasoning anthropocentric, biocentric and ecocentric. Kahn (1) states that the type of reasoning that shows a person's tendency to reason in solving the case or environmental problems contextual or fictitious whether solving these problems tend to the benefit of himself as a human being (anthropocentric), other living beings (biocentric) or environmental balance (ecocentric). Research of this kind of moral reasoning is not considered important for some teachers at school. Whereas the levels may be found the formal reasoning of the students are not in accordance with the level of informal reasoning. Level of moral reasoning is in conformity with the purpose of teaching materials, can make students aware of how to solve the environmental problems that occur. So that they will participate to help how to balance maintained environment. Because, with the formal knowledge of students about how the condition of biodiversity does not guarantee that they can associate with ecological problems correctly.

The research result Almeida (1) found that the school year is influenced by the child's age and cognitive development can have a positive influence on the reasoning non-anthropocentric (biocentric and ecocentric) but variable gender and frequency of contact (touch) the animals have no effect. These findings support further studies on this subject that the incidence of moral reasoning can biocentric depending on how the situation will be given to children (1).

Based on the research that has been presented, the authors wanted to find out how students, especially students in Indonesia are they has a moral reasoning on the surrounding environment and the problems being experienced. Factor in the future development of students studying on natural processes, increase environmental sensitivity
in their future (4). The relationship between environmental education and environmental awareness can contribute to shaping the attitude of the student environment (3). Additionally, through a known type of reasoning in students will facilitate teachers to determine the appropriate method of learning while teaching environmental issues which is not only for students but also known to be applied to the environment around them so that the ecological balance reasoning will awake. Marcelo (5) examined the environmental moral reasoning based Brazilian students of different social classes (age range 11-17 years) about biomes and wildlife. The results showed that students who have more contact with the natural landscape show greater affection for the environment. A large number of studies have been done to develop the kind of reasoning to measure various aspects of environmental awareness. Huckle & Sterling (in 7) states if we understand education for sustainable development, especially as the process of learning, the learner's perspective are a key factor in making education meaningful measures or means for an individual. Topic biodiversity and ecological problems have a high educational value as the main challenge for educators according to Dreyfus et al. (in 7). The material of this ecosystem is also a material that has always given ranging from education elementary school (ES), Junior High School (JHS), and Senior High School (SHS) or equivalent so that students early on can provide solutions to environmental problems being experienced.

On the other hand, the moral of the students who support the environmental balance will reduce environmental damage. Therefore, the teacher's role to build the much-needed moral to the environment in the future. Moral will be preceded by environmental concerns someone reasoning, moral reasoning that the environment would be his moral reasoning will increase the tendency to maintain the balance of the ecosystem along with increasing levels of education. Based on that statement, this study was conducted to identify whether the development of moral reasoning of students to the environment in accordance with the level or levels of education starting from ES, JHS, to SHS when given some issues of environmental problems that are happening.

**RESEARCH METHODOLOGY**

The research method is descriptive. Researchers wanted to know about the development of moral reasoning anthropocentric, biocentric and ecocentric to environmental issues in elementary school, junior high school, and senior high school. The model used in this study is cross-sectional when at the same time and the simultaneous use of different levels of variables to be investigated. The data obtained from each level of education can be described and subsequently sought comparing or association level. The study involved 19 ES students, 29 JHS students and 32 SHS students who come from schools run by an educational institution in the city of Bandung. This is done to avoid other factors that affect a person's reasoning process. The research data taken through the provision of questionnaire in the form of an open commentary and interviews. Some questions about some of the facts is taken from the ecological problems in Indonesia and outside Indonesia after being given judgements of some lecturer in environment. Analysis of the students' answers using the method of categorization of reasoning Kahn (in 1) regarding the reasoning anthropocentric, biocentric and ecocentric. Anthropocentric reasoning is the kind of reasoning that the reasons behind the answers given to a problem-centered environment to benefit of human fully. Biocentric reasoning is the kind of reasoning that the reasons behind the answers given to a problem-centered environment is not fully human but refers to the interests of other living creatures. Ecocentric reasoning is the kind of reasoning that the reasons behind the answers given to a problem-centered environment is not fully to human but refers to the balance and integrity of the ecosystem.
environment. This type of reasoning can be measured from answers to questionnaire open description is given regarding environmental issues.

RESULTS AND DISCUSSION

Research on the development of this type of moral reasoning anthropocentric, biocentric, and ecocentric regarding environmental issues in education elementary, junior high, and high school is done through two phases namely the provision of a description about open, and interviews. After processing the data, this study resulted in a written record of the categories of reasoning in elementary, junior high and high school. The data can be described in detail below.

**Development of Moral Reasoning anthropocentric, biocentric, and ecocentric on levels of education from ES, JHS, and SHS**

Type of moral reasoning anthropocentric, biocentric, and ecocentric identified from the answers given to the questions given students about environmental issues. Categorizing conducted an inclination conclusion of the three types of moral reasoning to answer ten questions test descriptions open. Found results categorization moral reasoning on the environment is divided into six types: anthropocentric, biocentric, ecocentric, antro-biocentric, anthro-eco-centric and mix bio-eco-centric in ES, JHS, and SHS. This happens because there is a conclusion that the answer is similar for the two types of moral reasoning. Many things that allow a person has some kind of moral reasoning because there are some that can affect moral reasoning. These factors include cognitive factors, environmental factors, factors of gender and educational factors. Data obtained from this study are varied can be caused in part by these factors.

Of the several theories associated with the development of reasoning one can say the development of moral reasoning to the environment is obtained if there is a change in the types of reasoning from an anthropocentric to biocentric or ecocentric reasoning of the lowest education level (ES) to the highest (SHS). But in this study found changes in the pattern of reasoning that is distinct from the development of moral reasoning conducted outside Indonesia. Here is a graph of the results categorization resulting in a pattern of moral reasoning in elementary, junior high, and high school (Figure 1).

![FIGURE 1. Developments of percentage anthropocentric, biocentric, and ecocentric reasoning in education level of elementary, junior high, and senior high school](image)

The moral reasoning at Figure 1. shows that the percentage of students from elementary through high school education is not showing clearly development of anthropocentric reasoning towards ecocentric. However, the reasoning of the pattern at
each level change, anthropocentric reasoning in elementary through high school education increased percentage. It was found that reasoning kind of anthropocentric most of the students' answers and then junior high school education, and the least at the elementary level. Biocentric in elementary through high school education the percentage is declining. Found most of the answers to students from elementary, junior high and then at least from the students' answers SHS. But, reasoning ecocentric not indicated on elementary students, it is precisely this kind of reasoning is found the highest percentage in the junior high school level. Changes in the type of reasoning ecocentric not form a clear pattern of development, because this kind of reasoning is most prevalent of the answer then junior high school students and found no pattern of this kind of reasoning in elementary students.

Theory of cognitive development proposed by Piaget (in 8) describes a child experiencing cognitive development in accordance with age. The cognitive development starting from the pre-operational stage (elementary education), concrete operational stage (junior high school education), until the formal operational stage (high school education). Type of moral reasoning a person can be influenced by cognitive development that occurs with age. Moral reasoning included in the preoperational stage of Piaget's theory is anthropocentric and biocentric. Anthropocentric reasoning is closed with the theory of egocentric proposed Piaget (in 8) which is to see the world and experience other people's point of view itself, but that does not mean selfish just that they are difficult to understand how the surrounding environment so that it always returned to his own advantage as humans (anthropocentric). It can also be included on the type of reasoning biocentric where a child will being all subjects (living things) that exist on environmental issues in question are themselves so that they are centered concealment advantage of the living beings (biocentric).

If associated with the theory of cognitive development Piaget, elementary students who are dominated by the kind of reasoning biocentric is true they are included in the stage of pre-operational although there are some students who have been able to reason from various aspects not just one aspect, namely that can reason on the type of reasoning mix between anthropocentric and biocentric. While a high school student who was also dominated by the answers reasoning anthropocentric inconclusive belong to the pre-operational stage because, as discussed earlier reasoning anthropocentric given is not solely for the benefit of people from one aspect, high school students are able to answer environmental problems given to be associated with various important aspects. The second stage of Piaget's theory of development is concrete operational are at an age equivalent to junior high school education. Moral reasoning develops at this stage is reasoning ecocentric and some mixed reasoning as it relates to understanding the concrete operational stage which has the basic characteristics of the introduction of logical stability and understanding the three basic aspects of reasoning that is identity, compensation and classification. With these capabilities, the system is thought to be a complete student and also logical. However, according to Piaget, at this stage the child is not able to think logically in abstract situations, only be able to think logically in concrete situations only.

When associated with Piaget's theory of development as above, junior high school students were dominated by biocentric and anthropocentric reasoning is not fully included in the concrete operational stage of development. Junior high school students in this study can be said the development of reasoning together with elementary students, it's just that there are some students who have been able to leave the properties and capable egocentric aspects of the ecosystem to answer questions about environmental issues to reason with the kind ecocentric. When high school students see the kind of reasoning is known that this kind of reasoning is dominated by the kind of anthropocentric. The high school students in Piaget's theory belongs to the formal operational stage. But unlike the theory of
high school students surveyed still much reason to use logic one direction that are biocentric and anthropocentric. But, as in the junior high school students, not all high school students are not in the formal operational stage, this is evidenced by the results of the categorization the student answers where there are six types of moral reasoning. This means that high school students can reason with takes into account various aspects in accordance with the theory of formal operational stage that at this stage the child is able to think about something abstract. Because it has been able to think of something abstract will appear ability to think hypothetically to consider various alternatives and identify all the possibilities that will happen. Because they can reason from the specific to the general principles, they are often critical of anything that is considered to be not in accordance with his wishes. So from the results of the data analysis associated with Piaget's theory of cognitive development in this study can be said that this type of moral reasoning of the students from elementary through high school education is not showing the development of anthropocentric reasoning toward ecocentric although not thoroughly. This is because there are few minority students of different types of reasoning with students of the same level which is considered to have a higher kind of reasoning. Therefore the reasoning of each hierarchically pattern can be said to change.

Moral Reasoning anthropocentric, biocentric and Ecocentric by Gender

Understanding gender is an inherent nature of men and women who are socially and culturally constructed (Martono, 2010). Gender differences in education can occur in the acquisition of learning achievement. This study will describe how the influence of gender on the type of moral reasoning anthropocentric, biocentric and ecocentric when asked about environmental issues. Here is a graph of the different types of gender-based reasoning of men and women (Figure 2.)

![Graph showing developments of percentage reasoning type anthropocentric, biocentric and ecocentric by gender](image)

**FIGURE 2.** Developments of percentage reasoning type anthropocentric, biocentric and ecocentric by gender

Figure 2 shows that men have a kind of reasoning that anthropocentric higher than in women with a difference of approximately 10%. This data can be interpreted that men are more likely to consider all components of living things and the environment is for the benefit of human and fully utilized for human needs of women. From these data can be interpreted that men respond more selfish when facing environmental problems than women. Since childhood male ego is formed in the relationship with the parents and after that, the man's ego is formed through interactions with friends and teachers at school. In general, they are shaping their environment as a strong man so they do not collapse under pressure and can survive in misery. Environmental problems confronted to several samples of men answered with response types and also anthropocentric anthropocentric solutions.
Anthropocentric tendency of man can be seen from the following examples and comparison reply with answers female subjects.

Men responded agreed with no consideration being that is in the protected forest with the answers of women who put the lives of other creatures than themselves as human beings. This is caused because women see themselves more prosocial, more empathetic, and they are also more involved in prosocial behavior compared to males (9). For example, a review of research found that, during childhood and adolescence, women are more in prosocial behavior (9). The gender differences occur in friendly behavior and pay attention to others, while the smallest difference in the behavior of share.

Both types of reasoning anthropocentric, biocentric, ecocentric, or a mixture of reasoning can be described that more men have the kind of reasoning that are favorable himself as a human being are like the kind of reasoning anthropocentric or mixtures thereof. While more women answered questions environmental problems with reasoning that is not concerned with their interests as human beings, but think of other components involved in these problems. Martono (6) says that women in the study conducted in the classroom, Identics with skill "jobs housewife". They are required to be calm, to be appreciated, caring, trustworthy, and willing to cooperate. For men hope more based on the criteria of academic skills such as knowledge, intellectual skills, and work habits (10).

Previous studies that also look at whether gender can affect a person's moral reasoning found no significant effect. In this study can also be seen that it is the percentage difference between the type of reasoning that is owned by men and women do not differ much, namely the highest level difference of 16% only. But still gender differences can affect how moral reasoning that in this study is the moral reasoning against environmental problems are the type of anthropocentric, biocentric, ecocentric and also a mixture of both the reasoning. To see more clearly the level of education whether the reasoning is based on gender differences, the following discussion is reasoning based on gender differences at every level of education.

**CONCLUSIONS**

Based on the findings of research and discussion in the previous chapter, the researchers conclude that type of moral reasoning of the students from elementary through high school education is not showing the development of anthropocentric reasoning toward ecocentric although not thoroughly. This is because there are few minority students of different types of reasoning with students of the same level which is considered to have a higher kind of reasoning. Therefore, the reasoning of the pattern at each level can be said to change. However, it can be said as well the development of moral reasoning to the environment that occurs not in accordance with his education.

Moral reasoning anthropocentric, biocentric and ecocentric influenced by gender differences. Male dominated by anthropocentric reasoning and female dominated by biocentric reasoning.

**ACKNOWLEDGMENTS**

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*Bandung, October 17th, 2015*
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The Effect of Application of Learning Cycle 5E of Conceptual Changes High School Student on The Concept of Coordination System

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Abstract

Depth understanding can only be established from the results of the learning process performed by the students. Student conceptual change by itself would change, if students want to change and accept the results of the learning process as something that is true, meaningful and useful in life. This study aimed to analyze the effect of the implementation of one of the constructivism namely learning cycle model, students' conceptual change in the concept of coordination system. The instrument used was a diagnostic three-tier tests. The method used is weak experiment with the design of the one-group pretest-posttest design. The study population was all students in SMA private Sukabumi, West Java, while the sample is determined by using purposive sampling. Results of calculations using the McNemar test are there conceptual change of students and Wilcoxon test there are significant differences conceptions number of students according to scientific criteria after posttest.

INTRODUCTION

Learning cycle (LC) models have been used by many researchers like Bybee et al. (2006), Balcit, S., Cakiroglu, J., and Tekkaya, C, (2006), Liu et al. (2009), Sadi, O., & Cakiroglu, J (2010), Yilmaz, D., Tekkaya, C., & Sungur, S. (2011), Tuna, A. & Kacar, A. (2013), Ajaja , OP, and Eravwoke, O. (2012), Patrick, O., A. (2012), and Tuna, A. & Kacar, A. (2013), the results have not been seen in detail changes in students' conceptions.

Several studies have been conducted to look at the students' conceptual change, as research conducted by costu and Artun (2012), which reveals the results of his research that learning activities based on the model LC 5E is an effective way for the creation of conceptual change, but little know about the real situation in Indonesia high School. Researchers want to see the students' conceptual change in the concept of coordination system, which in this concept students have difficulty understanding. Therefore, researchers are interested in applying the learning cycle to build students' knowledge and change in accordance with the concept of scientifically correct.

RESEARCH METHODOLOGY

Goals to be achieved in this study was to determine conceptual change after the student applied learning cycle. Based on these objectives the research methods used in this study is weak experimental research design the one-group pretest-posttest design (fraenkel & wallen, 2006). In this study will be used only one experimental group who will be given the treatment, carried out two tests, namely before the experiment and after the experiment.
About conceptual changes integrated with techniques three-tier-test (3T) is used as an initial test (pretest) and final test (posttest). Through these tests are expected to determine the increase and decrease in the quantity of conceptual change student misconceptions on the material coordination system. Diagnostic tests in the form of multiple choice questions. 1 misconception about the matter of identification (diagnostic tests) with three levels (three tier test), the first level is the usual multiple choice, the second level in the form of reason on the level to one, and the third level is the confidence index by 0-5 scale used to differentiate students who know the concepts, misconceptions, do not know and error. To facilitate researchers in the assessment on the first level, if the correct answer is worth 1, and if the wrong answer is worth 0. In the second level is the form of reason, if the correct answer is worth 1, and if the wrong answer is worth 0. at the third level, the confidence index scale is simplified into two 0 and 1, the value of the student becomes 0 if students choose not sure and very unsure, if choose 1 means the student confident or very confident in the answer to the question on level 1 and 2.

RESULTS AND DISCUSSION

Initial conception of students before undergoing a process of studying Biology is often incompatible with the scientific conception. However, the initial conception needs to be identified. It can help teachers diagnose aspects of thinking and cultivate students' conceptual change (Driver, 1980). Profile conception initial (pretest) and the final conception (posttest) on coordination system using a model 5E learning cycle, can be seen in table 1 below.

Table 1. Summary of Average Subconcepts Before and After Learning Model Using Learning Cycle 5E

<table>
<thead>
<tr>
<th>No.</th>
<th>Subconcepts</th>
<th>Pretest (%)</th>
<th>Posttest (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>T</td>
<td>TT</td>
</tr>
<tr>
<td>1.</td>
<td>The structure and function of neurons.</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>The mechanism of transmission of nerve impulses.</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>3.</td>
<td>The central nervous system (CNS).</td>
<td>27</td>
<td>13</td>
</tr>
<tr>
<td>4.</td>
<td>The peripheral nervous system (PNS).</td>
<td>17</td>
<td>23</td>
</tr>
<tr>
<td>5.</td>
<td>Abnormality or disorder and the effects of drugs on the nervous system.</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>12</td>
<td>20</td>
</tr>
</tbody>
</table>

Description: T (Know), TT (Do not Know), E (error), M (misconception).

From table 1 above shows that students' prior learning conception initially many had misconceptions, as big as 62.3%. This indicates that the initial conception of the students before the learning, not appropriate, intact and true to the nature of science. Only 12% of students who complete and correct conception fit the nature of science. While 20% of students do not know about the concept to be studied and 5.7% of students errors. Thus, it takes an effective learning process in accordance with known weaknesses. It is important to minimize misconceptions, errors and weak concept of controlled students.

Application of Learning cycle 5E, is one way to improve students' conceptual changes from the misconceptions become aware of concepts, from not knowing to knowing, and of error became know the concept of the right (intact) and in accordance with the nature of science.

Bandung, October 17th, 2015
After the learning process using the learning cycle, students' conceptual changes from the previously incompatible with the nature of science is correct and in accordance with the nature of science. Improvement of students 'conceptual changes can be seen from the increasing profile who know students' conceptions on the posttest 56.7%, from the previous 12%. So there are 44.7% of students who changed his conception properly and in accordance with the nature of science.

Students who do not know (weak in understanding the concept) decreased the percentage of pretest by 20% to 8% after the posttest, meaning that there are 12% of students who are not weak in understanding the concept. Likewise students whose error pretest decreased 5.7% to 4.7%, meaning that 1% reduction in student error. The highest decrease, occur in students who have misconceptions, 62.3% currently to 30.6% after the pretest posttest, meaning that 31.7% of conceptions are no longer misconceptions. The test is to see the students' conceptual change, the results of these changes as follows:

<table>
<thead>
<tr>
<th></th>
<th>Tahu</th>
<th>Tidak Tahu</th>
<th>Error</th>
<th>Miskonsepsi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest Percentage</td>
<td>12%</td>
<td>20%</td>
<td>5.7%</td>
<td>62.3%</td>
</tr>
<tr>
<td>Posttest Percentage</td>
<td>56.7%</td>
<td>8%</td>
<td>4.7%</td>
<td>30.6%</td>
</tr>
</tbody>
</table>

**Figure 1.** Percentage Graph Students Conceptual Change

In general Figure 1 above shows that there is a conceptual change of all students who were 30 people with different changes. It can be seen the results of conceptual change by drawing 1 pretest students who knew by 12% and increased to 56.7% after the posttest. Results conceptual change of students who know still below the passing grade is the standard unit of assessment for education on elementary and secondary education, the Ministry of National Education (Kemdiknas), ie ≥75.

43.3% of students still do not know (8%), error (4.7%) and misconceptions (30.6%). This proves that not all students have a conceptual change. This can occur due to a short learning cycle process. So that students can not connect existing concepts. Complex material is also one of the reasons why there are still 30.6% of students were misconceptions. Moreover, from the observation of only a few students who likes and enjoys biology. At the time of study students do a lot of extra curricular activities in preparation for school farewell celebration (imtihan), which makes some fatigue so that students can not concentrate well. Conceptual changes profiles of students in each subconcepts system of coordination can be seen in figure 2.
Figure 2. Comparison Chart Profile Conception Each Subconcepts

Examples of students' answers to question number six (subconcepts one), namely, how the passage of stimuli in nerve cells? When the answer pretest B (9 students), C (7 students), D (9 students) and E (5 students) selected by the student and answer A none of the students choose. When posttest only answer B (11 students), C (14 students) and D (4 students) that has been chosen students. Answer E of five pretest to 1 when the posttest, while there is still no answer A student one he chooses.

Students are seen from the results of an answer, in general almost half of students who understand the mechanism of conduction of nerve impulses. Students understand the stimulus runs through the body, but not too much focus that the running direction of the nerve cells. Students are still many who are fooled by the direction of propagation that is up to the brain.

Example E19 were answered D pretest reasons "because our nerves consist of a variety of needs. In the nerve cells that result in muscle there we could move, and have roots that flow to our organs "with a level of confidence, sure (misconceptions). Then when posttest E19 answered C on the grounds "because it works like a power plants that runs through the nervous system and the results was a change in the charge along the nerve cells", with a confidence level of confidence (to know). To determine students' conceptual changes in general, do statistical test McNemar.

Table 2. Calculation Results Significance of Conceptual Change Students on Coordination System

<table>
<thead>
<tr>
<th>No.</th>
<th>Subconcepts</th>
<th>McNemar</th>
<th>Wilcoxon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The structure and function of neurons.</td>
<td>9.6</td>
<td>Transform</td>
</tr>
<tr>
<td>2</td>
<td>The mechanism of transmission of nerve impulses.</td>
<td>13.06</td>
<td>Transform</td>
</tr>
<tr>
<td>3</td>
<td>The central nervous system.</td>
<td>28.19</td>
<td>Transform</td>
</tr>
<tr>
<td>4</td>
<td>The peripheral nervous system.</td>
<td>11.27</td>
<td>Transform</td>
</tr>
<tr>
<td>5</td>
<td>Abnormality or disorder and the effects of drugs on the nervous system.</td>
<td>23.04</td>
<td>Transform</td>
</tr>
</tbody>
</table>

From the results of Table 2, the results of statistical analysis (McNemar test) concluded that students' conceptual change about the system coordination after learning through learning cycle 5E. Students have a tendency to experience conceptual change on the fifth subconcepts coordination system, after learning through learning cycle 5E.

The highest conceptual change on the third subconcepts namely central nervous system (CNS), the calculation result (28.19) > X² (3.84), then Ho is rejected, with a confidence level α = 0.05. Furthermore subconcepts disorder or disturbance and the
influence of drugs on the nervous system, nerve impulse conduction mechanism, the peripheral nervous system and the smallest conceptual change is subconcepts structure and function of neurons.

Differences result of this conceptual change depending on student understanding and changes in accordance with the nature of science. Change can only happen if the four requirements that the proposed Posner experienced by students (Posner et al., 1982), that is students must be dissatisfied with existing knowledge, the new conception must be intelligible (the students understand the meaning of the new concept), the new concept must be plausible (student must find it believable), and the new concept must be fruitful (student can solve other problems using the new concept). Although given the same treatment results can differ depending on the ability and concentration of students in the learning process takes place.

Misconceptions tend to be difficult to repair after the learning process (Dikmenli, 2010). This fact should be encouragement for teachers to give examples for each concept according to the environment and understanding that students have prior learning. Thus the process of adaptation, either assimilation or accommodation can take place with a good and long-lasting changes in conception.

Whether the students’ conceptual change in the McNemar test significant or not, needs to be done Wilcoxon statistical tests. Results of comparative analysis of conceptual change between pretest and posttest obtained count $z = 9.12$. Because $z$ count $(9,12)$ located outside the acceptance interval, then $H_0$ is rejected. Conclusion There are significant differences in the number of students in accordance with the conception of scientific criteria after posttest. In other words, after learning through learning model learning cycle students tend to have a conceptual change in the concept of coordination system.

CONCLUSIONS

Learning cycle teaching model can improve students' conceptual changes in the system coordination. Increasing students' conceptual change with a change in the McNemar test each subconcepts, and the significance of conceptual changes in the system of coordination with wilcoxon test there are significant differences conceptions number of students according to scientific criteria after posttest.

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Students’ Understanding of Blood Circulatory System in Elementary School, Junior High School, and Senior High School

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Article info

Abstract

Content of blood circulatory system as topic to learn in elementary school (ES), junior high school (JHS), and senior high school (SHS). It is interesting to examine, whether this similarity will lead to clear improvement of students’ understanding. This research aims to analyze the development of ES, JHS, and SHS students’ understanding concept of blood circulatory system. This topic is chosen because it’s complex and many research discovered that the subject matters often lead to elusiveness. Descriptive research was conducted in one of the foundation schools in Bandung, by involving 28 grade 5 students of ES, 23 grade 8 students of JHS, and 29 grade 11 students of SHS. The research data were taken from open questioners about basic material of blood circulatory system in human. Interviews were conducted to further explore the students’ understanding. The research findings show, in average, ES students’ understanding are superficial, simple and concrete, unlike JHS and SHS students who have deeper understanding on the concept of blood circulatory systems, their organs, functions and mechanism. However, there is not much difference between JHS and SHS students’ understanding, since some JSS students have equivalent understanding SHS students and vice versa.

INTRODUCTION

Learning is a change in behavior as a result experience. The term is used to include such widely differing changes as responding differently to a signal, acquiring a skill, altering the way in which something is perceived, coming to know a fact, and developing an attitude toward something\textsuperscript{1}. Learning is an activity that is carried out in schools. School can facilitating students to develop the ability of cognitive, affective and psychomotor.

The education system applied in Indonesia using the sustainability of the system, some of the same topics to be covered at each education level, for example, topics in materials science (biology) on the ecosystem, digestive system, circulatory system and respiratory system. The length of their study is supposed to give good influence to their understanding, such as to blood circulatory system.

In fact, some research has been done by previous researchers, their showed at every level of education, students have an alternative perspective and intellectual model of the concept and some of the parts on the concept does not change and sustainability even though the student has been continuing to further education\textsuperscript{2}.

Content of blood circulatory system as topic to learn in ES, JHS, and SHS. This topic is complex and many research discovered that the subject matters often lead to elusiveness. Arnaudin & Mintez found that the different levels of education found some misconceptions about the circulatory system to the concept of the structure of blood, blood
function, liver structure, function of the heart, circulatory patterns, relationships circulatory, respiratory and circulatory closed. According to students who have this misconception indicated it is difficult to change these misconceptions.

Moreover Chi in Lee and Kim (2013) found in his research the fact that many students find it difficult to construct materials circulatory system involving oxygen, the function of the lung, the number of blood vessels and circulatory. They face difficulties in understanding how one organ to another organ to work with each other. The existence of this ignorance makes the students are not able to explain and understand well the circulatory system.

RESEARCH METHODOLOGY

This descriptive research purpose to describe student’s understanding of blood circulatory system in Elementary, Junior and Senior High School and to find out the difficult concept in blood circulatory system. This research was conducted in one private school in Bandung involving 28 students in grade 5 ES, 23 JHS students in grade 8, and 29 SHS in grade 11.

Concept of students' understanding described based on the answers their given in the description from the open questioners. Interviews were conducted to further explore the students’ understanding. In this studies used education and the concept of the material circulatory system as a variable in the students’ concept understanding. This study was conducted with a cross-sectional models, where researchers at the same time and the simultaneous use of different levels of variables to be investigated.

The research instruments to be used are open questionnaire containing the basic materials in the human circulatory system. The instrument contains four questions, each of which ask the concept of the structure of the human heart, the role of blood vessels, blood compositions, and blood clotting. The concept was chosen because that are the basic knowledge of blood circulatory system and these topic are applicable in daily life.

Each sample in every level got same instrument, but the elementary students there are additional descriptions to help students understand the question. The instrument used was tested on every level and has been revised based on the results of the evaluation of the trials.

Students’ answers were categorized based on the broadness and accuracy. The answers at every level of matter be sorted by number, this grouping is used to make easier in describing the research data. The group is made based on the answers of students at all levels, the greater the number, the more complex concepts group controlled by the student. Grouping the results are calculated and made the percentage that can be seen average students’ understanding of concept on each question in each level.

Unstructured interviews was done because in general the answers are on the results answer open questionnaire that has been answered by the students just that researchers still do not understand the answer, therefore, the questions that asked to each student is not the same, depending on the students' answers which less obvious at every point. Interview also conducted to answer some of the best students in explaining the concept and the students who answer indicate understanding of the concept is not yet right.

<table>
<thead>
<tr>
<th>Number</th>
<th>Matter</th>
<th>Category</th>
</tr>
</thead>
</table>
| 1 | Heart is one important organ for human. How is structure of human heart which you know? | 1. Students drew the structure of a heart, yet inaccurate  
2. Students drew the structure of a heart consist of |
Draw and explain the part.

3. Students drew the structure of a heart consists of four chambers and each has valve

Blood is one component in a body that has many roles, such as the body's defenses and distribute in nutrients to the body cells. Explain how can the blood flow in the body?

1. Students responded with a concept that is not inaccurate
2. Students knew that the blood in the form of liquid so that blood can flow
3. Students knew that the blood flowing through blood vessels
4. Students knew that the blood flowing through blood vessels with the help of heart
5. Students knew that the blood flowing through blood vessels with the help of the heart and its mechanism

Explain why human blood red?

1. Students responded with a concept that is not precisely
2. Students explained the blood is red because of a substance (students didn’t know the name of the substance)
3. Students knew and associate red blood on blood composition
4. Students knew the blood is red because there is hemoglobin

When we hurt the skin, blood can come out of the wound. But after some time the wound is closed so that the blood is no longer out. Explain how it can happen, why such injuries can be closed?

1. Students responded with a concept that is not precisely
2. Students explained the wounds can dry
3. Students explained the blood can froze when injured
4. Students explained the role of platelets
5. Students explained the mechanism of platelet activating fibrinogen

RESULTS AND DISCUSSION

Based on the findings of the data, it showed differences in the depth of students’ understanding of the concept development. There is a growing concept understanding in ES, JHS, SHS, but there is also the understanding of concept development is not much different between levels of education, and there is also a concept understanding whose development did not improve at the next level.

This development of process is certainly influenced by various factors, as described by Piaget in Kuswana (2013:159), that each individual in his life always interact with the environment where a person will get the scheme in the form of a category of knowledge that helps in interpreting and understanding the concept.

Table 2. Table concept understanding students’ on the material circulatory system

<table>
<thead>
<tr>
<th>Concept</th>
<th>ES</th>
<th>JHS</th>
<th>SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of Human Heart</td>
<td>Hasn’t understood</td>
<td>Understood the structure of a heart consist of four chambers</td>
<td>Understood the structure of a heart consist of four chambers</td>
</tr>
<tr>
<td>The role of blood vessel</td>
<td>Understood the concept of blood flow because of the heart as blood pump</td>
<td>Understood the concept of blood flow because of the heart as blood pump</td>
<td>Understood the concept of blood flow because of the heart as blood pump</td>
</tr>
</tbody>
</table>

Bandung, October 17th, 2015
The development of student’s understanding about the structure of the human heart

Understanding the concept of ES, JHS and SHS show their development in understanding the concept of the human heart structure, this development can be seen from the number of answers of students in each group. On average understanding of the concept of ES students are at the stage yet understood concept to master the concept that the heart have the chambers. At the JHS school students, on average, have understood the concept of the heart consists of four chambers to the heart consists of four chambers and valves. While the average understanding of the concept of high school students are between the stages have not understood the concept to master the concept that the heart has four chambers.

**Table 3.** The percentage of students' understanding of concepts concerning the structure of the human heart

<table>
<thead>
<tr>
<th>Category</th>
<th>ES</th>
<th>JHS</th>
<th>SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Students drew the structure of a heart, yet inaccurate</td>
<td>53,5%</td>
<td>-</td>
<td>3,0%</td>
</tr>
<tr>
<td>2 Students drew the structure of a heart consist of four chambers</td>
<td>46,5%</td>
<td>87,0%</td>
<td>97,0%</td>
</tr>
<tr>
<td>3 Students drew the structure of a heart consists of four chambers and each has valve</td>
<td>-</td>
<td>13,0%</td>
<td>-</td>
</tr>
</tbody>
</table>

The development of student’s understanding about the role of blood vessels

Understanding the concept of ES, JHS and SHS show their development in understanding the concept of the role of blood vessels in the mechanism of the circulatory system, this development can be seen from the number of answers of students in each group. On average understanding of the concept of ES students are at the stage yet understood concept to explain that the blood flow because of the heart as the organ pumping blood and students to explain the mechanism. At the JHS and SHS average of understanding of the concepts is the stage between explain the existence of organ blood vessels to explain that the blood flow because of the heart as the organ pumping blood and students to explain the mechanism.

**Table 4.** The percentage of students' understanding of concepts concerning the role of blood vessels

<table>
<thead>
<tr>
<th>Category</th>
<th>ES</th>
<th>JHS</th>
<th>SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Students responded with a concept that is not precisely</td>
<td>25%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2 Students knew that the blood in the form of liquid so that blood can flow</td>
<td>18%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 Students knew that the blood flowing through blood vessels</td>
<td>21%</td>
<td>30%</td>
<td>14%</td>
</tr>
<tr>
<td>4 Students knew that the blood flowing through blood vessels with the help heart</td>
<td>29%</td>
<td>35%</td>
<td>62%</td>
</tr>
<tr>
<td>5 Students knew that the blood flowing through blood vessels with the help of the heart and its mechanism</td>
<td>7%</td>
<td>35%</td>
<td>24%</td>
</tr>
</tbody>
</table>

The development of student’s understanding about blood composition

Understanding the concept of ES, JHS and SHS show their development in understanding the concept of the composition of the blood in human, this development can
be seen from the number of answers of students in each group. On average understanding of the concept of ES students are at the stage yet understood concept to explain the red blood and the blood that relate to the composition consists of red blood cells. At the JHS and SHS students' understanding of the concept is not yet understood the concept stage to explain because there are red blood hemoglobin.

Table 5. The percentage of students' understanding of concepts concerning blood composition

<table>
<thead>
<tr>
<th>Category</th>
<th>ES</th>
<th>JHS</th>
<th>SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Students responded with a concept that is not precisely</td>
<td>40%</td>
<td>22%</td>
<td>14%</td>
</tr>
<tr>
<td>2 Students explained the blood is red because of a substance</td>
<td>32%</td>
<td>22%</td>
<td>4%</td>
</tr>
<tr>
<td>(students do not know the name of the substance)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Students knew and associate red blood on blood composition</td>
<td>28%</td>
<td>34%</td>
<td>-</td>
</tr>
<tr>
<td>4 Students knew the blood is red because there is hemoglobin</td>
<td>-</td>
<td>22%</td>
<td>82%</td>
</tr>
</tbody>
</table>

The development of student's understanding about blood clotting

Based on the data that have been obtained, there is the development of students' understanding of the concept of the blood clotting process on ES to the junior high but there was no continuity in SHS student. Percentage of grouping results showed an average understanding of ES and SHS students are at the stage yet understood how the wound healing process. While the average JHS students a deeper understanding than the elementary and high school students, JHS students have understood the role of platelets in the wound healing process.

Table 6. The percentage of students' understanding of concepts concerning blood clotting

<table>
<thead>
<tr>
<th>Category</th>
<th>ES</th>
<th>JHS</th>
<th>SHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Students responded with a concept that is not precisely</td>
<td>60%</td>
<td>-</td>
<td>51%</td>
</tr>
<tr>
<td>2 Students explained the wounds can dry</td>
<td>26%</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3 Students explained the blood can froze when injured</td>
<td>14%</td>
<td>12%</td>
<td>-</td>
</tr>
<tr>
<td>4 Students explained the role of platelets</td>
<td>-</td>
<td>48%</td>
<td>34%</td>
</tr>
<tr>
<td>5 Students explained the mechanism of platelet activating fibrinogen</td>
<td>-</td>
<td>40%</td>
<td>15%</td>
</tr>
</tbody>
</table>

This understanding concept development can be caused by assimilation and accommodation happened to the concept of the circulatory system that is controlled by the student. Through these two processes of cognition someone systems evolve and change so that it can increase from one stage to a higher stage, the process is done so that a state of balance between the structure of cognition with experience in the environment. Thus a person cognition evolved not because receiving knowledge from outside passively, but the person is actively constructing knowledge. In the cases in this study, the average high school student already knows combinations between concepts he has received since he was in elementary, but the structure of cognition with experience in the environment is not balanced. Students find it difficult to restructure the concepts that they already have, so that when answering questions they answer becomes less precise.

CONCLUSIONS

The findings of this study show there is development in students’ understanding toward the concept of the structure of a heart, the role of blood vessels and blood composition. But the development in students understanding toward the concept of blood clotting did not occur. And elementary students difficult to understand abstract concept
involving mechanisms on the circulatory system. While the junior and senior high school students were difficult to associate the concept in explaining the concept of an organ or process in blood circulatory system.

REFERENCES

The Roles of Formative Assessment in Developing Biology Student’s Habits of Mind

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Abstract

A study about the role of formative assessment towards the development of students’ habits of mind was conducted to describe contribution of formative assessment (feedback, self-assessment and peer-assessment) towards habits of minds (self regulations, critical thinking and creative thinking) and the students’ responses towards the formative assessment applications. The research method used was Research and Development. The research was conducted with the involvement of a number of students who join Phanerogamic course at UPI as research subjects. Data was collected using sets of test, classroom observation, questionnaire, interview and field notes which then were analyzed in quantitative and qualitatively. This research resulted in the formative assessment application program towards the habits of mind which was the combination of component and formative assessment strategy applied in theoretical and practical course. The application of formative assessment in terms of microassessment (frequent, continuing, in/on time, short and focusing) gave impacts on the increasing of habits of mind in middle category. The research findings showed that the feedback component distributed the greatest contributions towards the habits of mind and that the formative assessment distributed the greatest contributions towards self-regulations. Positive responses were shown by the students in relation with the formative assessment applications such as the students became more creative, discipline, accurate, time-respecting, hard-working, interested in and was care for plants and aware of God.

INTRODUCTION

Education is a conscious effort to develop people into adulthood. This includes aspects of maturity of intellectual, social and moral. The purpose of education is not only developing the intellectual aspect of knowledge or mastery of course material, but also must be balanced with the attitudes and skills. This is consistent with the goal of learning outcomes that require a balance between intellectual ability (cognitive), attitudes (affective) and skills (psychomotor). Teachingpracticein schoolsis still lothatis solelyoriented on the mastery of the subject matter. Observation of the day-to-day practice of education shows that education is focused so that students master the information contained in the subject matter (memorize). This reality does not fit with the educational goals outlined above, which require a balance of learning outcomes between intellectual abilities, attitudes and skills.

The most important goal of education is to develop the mental habits that allow individuals to learn about all the things they want or they need to understand everything to do with his life. Every individual in his life will be faced with a variety of issues, academic or personal problems. Sometimes the problem is simple and easy to overcome, but often the problem is difficult to overcome. In situations when an individual does not know how...
to respond to these problems, necessary intelligent behavior to overcome, in the sense not only find information but also knowing how to act. The ability of intelligent behavior is referred to as habits of mind (HoM) [1].

Researchers in the field of cognitive psychologists find that in addition to having the ability to think, humans also have the ability to control his behavior, using effective habits of mind. Some figures (Ennis, 1987; Paul, 1990; Costa, 1991; Perkins, 1984; Flavell 1976; Zimmerman, 1990; Amabile, 1983 in [2]) puts the habit of thinking into three categories: self-regulation, critical thinking and creative thinking. Meanwhile some other figures [1] [3] [4] divides habits of mind into 16 indicators more or less similar to that developed by Marzano et al. [2].

If the observed indicators of the habits of mind that proposed by Marzano [2] [1] [3] and [4] shows that these indicators equip individuals to develop mental habits is the goal education is important. Even Costa and Callick [3] and Campbell [5] claims habits of mind as the behavioral characteristics of the most highly intelligent thinking to solve problems and is an indicator of success in academic, work and social relationships. The question is, by what habits of mind will be trained and developed?

Assessment formative interpreted as an all the activities who relating with activity who done teacher and students that provide information as feedback for fix and modifying the activity of learn teaching [6]. Formative assessment is often used as a diagnostic tool for students and teachers in giving information so that repairs methods of instructional, the material, activity and approaches can be done with precisely.

Research related to the provision of formative assessment and feedback have been carried out [7] [16] and [9]. These studies showed that administration of the assessment results and general feedback can motivate student learning, encouraging student to be interested in the topics being taught, improve learning outcomes and lead to optimism, self-confidence and appreciation of students.

The positive impact of providing formative assessment form factors: motivation, self-regulated learning, optimism, self-confidence, appreciation, to develop the potential of metacognition, willing to take risks are all factors that also developed the habits of mind. However, the extent to which the relationship between the positive impact of formative assessment with the formation of habits of mind has never been studied. Based on the background of the perceived research needs related to the implementation of formative assessment in forming habits of mind students of biology. Based on the background described above, the problem is formulated as follows: "How to implement formative assessment that can contribute to forming habits of mind students of Biology?"

**RESEARCH METHODOLOGY**

The research was carried out referring to the design of Research and Development of Borg and Gall [10]. Design includes four stages, namely: 1) a preliminary study, 2) the preparation and development of the program, 3) testing program and, 4) the implementation of the program. To describe the increase in habits of mind beginning to the end of the experimental method is used to design pre one-group pretest-posttest design.

The study was conducted in the Department of Biology Education of UPI Bandung on Phanerogamae Botany courses. This course represents the biodiversity subject that have the same characteristics in the aspects: teaching materials, the theory lectures and practical, providing similar tasks, especially in the lab and the notion that diversity courses subjects considered difficult, uninteresting, boring and memorizing

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The study involved 86 students, 51 people in the testing phase and 35 people on the stage of program implementation.

The instrument used in this study is a test, questionnaire, habits of mind, observation, device, performance, and presentation, task and rubric for a variety of tasks, questionnaire, and interview format.

Data were collected through a variety of instruments were analyzed quantitatively and qualitatively. Quantitative analysis is done by calculating the N gain, HoM correlation with formative assessment, regression analysis and path analysis to describe the contribution of formative assessment component of the category HoM.

RESULTS AND DISCUSSION

RESULT

1. Components and Implementation of Formative Assessment Strategies

Through a preliminary study of the 12-15 known that subjects who had taken the third and fourth semester students, only 31% are implementing formative assessment. Most subjects impose duties of students as a summative assessment. The same thing happened in the course Phanerogamiae Botany. Through PAFTHoM program, the process of learning activities along with the tasks given in this course apply formative assessment. Formative assessment is given based on the components and the various strategies. Formative assessment component consists of feedback, self-assessment and peer assessment. There are eight formative assessment strategies applied in this study are applied to the theory and practical classes. Formative assessment strategies are: 1) the collection of resource books, 2) making the presentation material in the form of media power point, 3) presentation group in theory, 4) chart concept, 5) observation practicum performance, 6) presentation practicum group, 7) duty drawing and, 8) lab report.

Through various formative assessment strategies, habits of mind students explored and developed and captured through a variety of instruments. Percentage of student achievement obtained through various formative assessment strategies were grouped into categories of excellent, good, adequate, less and less so, and are presented in Table 1.

<table>
<thead>
<tr>
<th>No.</th>
<th>Formative Assessment Strategies</th>
<th>Category (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Group theory presentation</td>
<td>71 Excellent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>29 Good</td>
</tr>
<tr>
<td>2.</td>
<td>Performance lab</td>
<td>100 Excellent</td>
</tr>
<tr>
<td>3.</td>
<td>Group lab presentation</td>
<td>31 Excellent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>55 Good</td>
</tr>
<tr>
<td>4.</td>
<td>Chart concept</td>
<td>45 Excellent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45 Good</td>
</tr>
<tr>
<td>5.</td>
<td>Drawing task</td>
<td>97 Excellent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Good</td>
</tr>
<tr>
<td>6.</td>
<td>Lab report</td>
<td>100 Excellent</td>
</tr>
</tbody>
</table>

2. Contribution Formative Assessment Collaborative the HoM

The contribution of formative assessment together (feedback, self-assessment and peer assessment) to the HoM known by correlation and regression analysis to correlate the student questionnaire with HoM final value. Correlation of test results on the implementation phase are presented in Table 2.

<table>
<thead>
<tr>
<th>Variable</th>
<th>r count</th>
<th>r table Pearson</th>
<th>Description</th>
</tr>
</thead>
</table>

Bandung, October 17th, 2015
Table 2. shows that there are significant r count on variable HoM-feedback and HOM-self-assessment, while the variable HoM-peer assessment results showed no correlation significant. To describe the contribution of formative assessment together to HoM, testing followed by regression analysis to obtain the value of $R$ and $R^2$. $R$ values obtained 0.639 which shows a high correlation between formative assessment and HoM. The value of $R^2$ is to note the contribution of formative assessment to the HoM is equal to 0.408, meaning that 40.8% of students HoM caused by the application of formative assessment.

3. Formative Assessment Component contribution to the HoM Category

Contribution of each component of formative assessment (feedback, self-assessment, and peer assessment) towards each category of HoM obtained through path analysis and regression analysis. The results are presented in Table 3.

Table 3. Formative Assessment Component Contribution Towards The HoM Category

<table>
<thead>
<tr>
<th>Formative Assessment</th>
<th>Feedback</th>
<th>Self Assessment</th>
<th>Peer Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self regulation</td>
<td>29.5%</td>
<td>7.7%</td>
<td>1%</td>
</tr>
<tr>
<td>Critical thinking</td>
<td>2.5%</td>
<td>20.2%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Creative Thinking</td>
<td>22.4%</td>
<td>2.5%</td>
<td>3.5%</td>
</tr>
</tbody>
</table>

Feedback significantly contribute to the formation of categories of self-regulation and creative thinking is better than critical thinking category with a value contribution of 29.5% and 22.4%. Self assessment component contribute better to the category of creative thinking and self-regulation by the value of the contribution respectively 20.7% and 7.7%. Contribution of peer assessment only looks at the categories of creative thinking with a relatively small value (3.5%). In general, the most formative assessment components contributing to the HoM is a feedback component.

To describe the HoM category most affected by formative assessment, done well correlation and regression testing formative assessment together against each category of HoM and the results are listed in Table 4.

Based on Table 4 formative assessment together (feedback, self-assessment and peer assessment) contributed the most to the category of self-regulation that is 55.5%. Formative assessment followed contribution to the category of creative thinking by 31.1% and the critical thinking category of 29.9%.

Table 4. Formative Assessment Contributes to The HoM Category

<table>
<thead>
<tr>
<th>Formative Assessment</th>
<th>HoM Category</th>
<th>Total Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Self Regulation</td>
<td>55.5%</td>
</tr>
<tr>
<td></td>
<td>Critical Thinking</td>
<td>29.9%</td>
</tr>
<tr>
<td></td>
<td>Creative Thinking</td>
<td>31.1%</td>
</tr>
</tbody>
</table>
Increased habits of mind students in the class known implementations based on the value of N-gain. The results of recapitulation the percentage of gain normalized implementation class are listed on Table 5. In the implementation class of N-biggest percentage gain by HoM students in middle category is as much as 60%. N-value average gain of 0.42 is obtained which includes medium category, meaning an increase in HoM students before and after application of formative assessment in middle category.

**Table 5. N-gain Grouping Based Students HoM**

<table>
<thead>
<tr>
<th>No.</th>
<th>Gain normalized</th>
<th>Number of student</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Low</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>2.</td>
<td>Middle</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>3.</td>
<td>High</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Jumlah</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

4. **Student response to the Application of Formative Assessment**

Student response to the implementation of formative assessment through questionnaires captured. There are five open-ended questions include: (a) whether or not a student enjoys after attending in the implementation of formative assessment, (b) the severity of the tasks, (c) the benefits of the tasks, (d) impressions after attending the eye college with the application of formative assessment, (e) the order of the most influential formative assessment on student thinking habits.

The first question was answered by all students (100%) to please this course after adopt it. Reason student enjoys the course as students become more creative, innovative, disciplined, meticulous, knows how to learn is good and right, forming the character better, train manage themselves, lecturers always give motivation and encouragement, teaching methods readily accepted because faculty interaction intensive-students, get to know the diversity of plants, plant care more around, want to learn more in plant and realize the greatness of the God.

The second question relates to the tasks given, answered not burdensome majority of students (86%). The reason is not burdensome tasks because students benefit from such tasks include students being disciplined, appreciate the time and willing to work hard. The third question relates to the benefits of the tasks given and 100% of students claimed to benefit from a given task. Benefits obtained student assignments include: more productive, planning, trying to think creatively and carefully, useful feedback to interospeksi self, respect for others.

The fourth question relates to the students’ impressions of Botany Phanerogamae subjects. As many as 28% of the students got the impression that the subject is interesting, and 20% of students stated that lecturers provide a clear explanation of the subject matter Phanerogamae Botany. 14% of students expressed interest and concern raised high against the plant.

The fifth question relates to the order of the most influential formative assessment component that student according to the HoM. As many as 41% of students choosethe order of the feedback-self assessment-peer assessment.

**DISCUSSION**

Implementation of formative assessment on student tasks need to be done, especially because formative assessment feedback encourages students to enhance their learning motivation, correcting the mistakes made or leaving negative things of weakness in the study [12]. A similar sentiment was expressed by Ramaprasad [13], Sadler
that student feedback is necessary as it can help them realize the difference in the gaps between the objectives to be achieved with the knowledge, understanding, and skills possessed by students, so that they can lead to acting in achieving these goals through a variety of ways.

Before applied PAFTHoM program, the tasks in subjects Botany Phanerogamae collected and treated as end of semesters summative assessment. Not given feedback on student assignments, causing students do not get a chance to realize the gap between what has been achieved with what should have been achieved.

Changes in the implementation of formative assessment is applied to the implementation phase that is microassessment primarily on the timeliness of providing formative assessment, positive impact on some of the results of the study. First, the comparison results of correlation testing phase with the implementation phase showed significant results in HoM-feedback and HoM-self assessment, as listed in Table 6. In the pilot phases showed significant results only on HoM-self assessment.

Table 6. Correlation of Test Result on the Pilot phase and Implementation Phase

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pilot Phase</th>
<th>Implementation Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>HoM – Feedback</td>
<td>Not Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>HoM – Self Assessment</td>
<td>Significant</td>
<td>Significant</td>
</tr>
<tr>
<td>HoM – Peer Assessment</td>
<td>Not Significant</td>
<td>Not Significant</td>
</tr>
</tbody>
</table>

When compared to the correlation test performed on variables HoM-peer assessment in the pilot phase and the implementation phase, still showed no significant correlation. Second, jointly contributing components formative assessment (feedback, self-assessment, and peer assessment) increased the formation of HoM. In the pilot phase, the contribution of formative assessment to the students HoM of 17.3%, an increase in the implementation phase amounted to 40.8%. Third, based on the average value of N-gain, an increase in HoM phase which includes categories is 0.42. When viewed in percentage of normalized gain category, the percentage being the highest category by 60%.

An increase in research on the third study (results of correlation, contributing to HoM formative assessment and improvement HoM) in the implementation phase can not be separated from the process of extracting and HoM development through formative assessment strategies are applied for one semester.

Formative assessment strategies are applied to the implementation phase of the program include group presentations on theory, concept charts, performance observation lab practice group presentations, the task of drawing and lab reports are microassessment. This term is used by Thin [16] for an assessment that is often, short and focused. While Gibbs and Simpson [17] states that effective feedback is frequent, timely, and detailed enough. Formative assessment strategies as mentioned above carried out regularly and continuously every week on this study in order to obtain optimal results and form the habits of mind students. Through microassessment students have the opportunity to obtain feedback on their duties and conduct a self-assessment with more frequent/continuous, and fast. Thus there is a lack of information about outcomes and learning process improvement implementation strategies change even at that time [12]. A similar sentiment was expressed in the research Thin [16] that the use of formative assessment that is microassessment can improve student learning outcomes.

Of eight formative assessment strategies applied in this study, peer assessment only applied to two formative assessment strategies, namely the presentation of strategies...
theory and practical presentations. Number of peer assessment application opportunities are limited effect on the test results. To more clearly the contribution of each of the categories of formative assessment HoM is presented in Figure 1.

![Figure 1](image)

**Figure 1.** Formative Assessment Component Contribution Toward The Category of HoM in Percent (%) After Implementation The Formative Assessment

Description:

- **UB – SR** = Contributing feedback on *Self regulation*
- **UB – CriT** = Contributing feedback on *Critical Thinking*
- **UB – CreT** = Contributing feedback on *Creative Thinking*
- **SA – SR** = Contributing *Self Assessment on Self Regulation*
- **SA – CriT** = Contributing *Self Assessment on Critical Thinking*
- **SA – CreT** = Contributing *Self Assessment on Creative Thinking*
- **PA – SR** = Contributing *Peer Assessment on Self Regulation*
- **PA – CriT** = Contributing *Peer Assessment on Critical Thinking*
- **PA – CreT** = Contributing *Peer Assessment on Creative Thinking*

When looking at the importance of peer assessment, as proposed by Reinhartz and Beach [18] that peer assessment can foster collaboration and the ability to work together as an integral part of learning science and can coach communication skills, writing and reporting what he was doing. As well as the opinion of Black et al., [19] that the peer assessment uniquely valuable, because students are more receptive to criticism against his work friends than when the criticism is given lecturers / teachers. Then peer assessment needs to be practiced continuously in a long time and through a variety of formative assessment strategies. Obtained from this study indicate that the need is more than twice the application of peer assessment to obtain a meaningful contribution to the formation of student HoM.

Table 3. show that the self-assessment and feedback make a meaningful contribution to the three categories of HoM, compared with peer assessment. This happens because the component feedback and self-assessment implemented in eight formative assessment strategies.

Oral and written feedback given continuous feedback in the form of corrections to errors or omissions made by students, guiding students to assess themselves. Information relating to errors and shortcomings in the tasks, helping students realize the differences in gaps between the objectives to be achieved with the knowledge, understanding and skills possessed by students to correct deficiencies and mistakes he made in an effort to achieve that goal [13] [14] [15]. Feedback is given immediately and at any time of assessment strategies applied in this study provides a good contribution to the formation of student HoM. Because the feedback is given immediately, students can immediately identify the weaknesses or shortcomings of his duties and can make
improvements on the next task so that students can improve the quality of their work. This is supported by the opinion of Dahar [20] which stated that feedback should be given immediately so that student responses are not appropriated and does not develop into undesirable habits.

Black and William [6] stated that students tend to not know the targets to be achieved in the learning, so students need to be trained to perform self-assessment to get an idea of learning and knowing what is needed to achieve these targets.

In this research, the lecturers, lab assistant and student peers provide oral and written feedback on formative assessment strategies are applied. Given feedback gives students the opportunity to conduct self-assessment, which is followed by the onset of student awareness of the targets to be achieved. Therefore, it can be that the feedback component is a component of most major categories contributed to the HoM, then self-assessment component, because it is usually self-assessment comes after a person gets feedback.

Feedback is provided on various formative assessment strategies, led to self-assessment. In other words, self-assessment done by the students after the students were given feedback that causes students realize goals or targets to be achieved. Related to the results of research, initially at least, contributing feedback both on self-regulation, as students can make arrangements for her, then based on the feedback, the students do creative thinking involved in each task, and attempts to have a standard of evaluation, even though the results are not immediately apparent. Feedback provided then led to the ability of self-assessment, especially in the category of creative thinking. Critical thinking abilities needed to do the tasks with maximum results. Based on the average formative assessment of the contribution of each category HoMs listed in Table 4. indicates that formative assessment contributes to each category a row from the largest to the smallest is on self-regulation (55.5%), creative thinking (31.1%) and critical thinking (29.9%). Formative assessment is provided through a variety of strategies, the first effect on self-regulation, after realizing students and improving self-management, followed by their efforts and the work involved in these tasks (creative thinking). Efforts are made to train students with critical thinking skills so that the resulting tasks with good quality.

Positive response to the implementation of formative assessment through analysis of student questionnaires indicated. Positive response regarding the habits of mind are the students feel more creative, innovative, disciplined, appreciate the time, tolerant of a friend, willing to work hard, and others.

After studying plants in the Botanical Phanerogamae course students become more interested in plants, get to know the diversity of plants, arises a sense of care for the plants, would like to learn more plants in and realize the greatness of the God. The student response is encouraging because the study Wulan [21] on the same subjects showed a worrying fact that 88% of students think that the decline of biodiversity as environmental issues are issues that are less important and less urgent. The positive response of students to ease fears Rifai [22] relating to the preservation of the existence of plants in Indonesia, because we do not know the details of the number of living things that exist in Indonesia. At least with the advent of the positive attitude of students to concern primarily biological keanekaragamn Indonesian plants through lectures Phanerogamae Botany, add a cadre of people who care about the genetic wealth of Indonesia.
CONCLUSIONS

Implementation of formative assessment to establish habits of mind students can proceed by applying PAFTHoM program. Formative assessment component is implemented consisting of feedback, self-assessment and peer assessment. And formative assessment strategies were applied consisting of: 1) the collection of book sources, 2) making presentation materials, 3) the theory of group presentations in lectures, 4) chart concept, 5) observation practicum, 6) presentation on lab activities, 7) duty drawing and 8) lab report. Eighth formative assessment strategies applied microassessment (frequent, continuous, timely, short and focused). Through correlation and regression known contribution of formative assessment together (feedback, self-assessment and peer assessment) on the formation of habits of mind students at 40.8%. Contribution of each component of formative assessment of each student category HoM Biology suggests that feedback and self-assessment provide a greater contribution than the peer fee.

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The Development of GeneTIK as an Integrated Technology, Pedagogy and Content Knowledge (TPACK) on Genetic Course for Biology Education Student

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Abstract
The studies on developing genetic lecturing system GeneTIK which integrate technology, pedagogy and content has been done. The study aims to get an idea of how to package the content of genetics course and pedagogy in the context of teaching and learning supported by appropriate technology. There are three interrelated components in the study namely technological knowledge, content knowledge content knowledge and pedagogical knowledge. The three components are integrated to form a unity as the technological pedagogical content knowledge (TPACK). The development of TPACK carried out during the research has succeeded in creating a system that accommodate TPCK called GeneTIK to lecture genetic course. GeneTIK formation process begins with the analysis of genetic course content including contents dimensions and characteristics of the concept for lecturing system. Based on knowledge of the contents the step of development lecturing system continued to identify the specified of teaching and learning characteristics, including devices and media are matched. The next step is to identify the technologies that enable to accommodate the characteristics of teaching materials and how implemented in real situation. The kind of technological aspect has integrated in the GeneTIK is information and communication technology (ICT).

INTRODUCTION

The presence study of ICT in education has resulted in a change paradigm structuring and management of education at almost every level. Biggs (2003) distinguishes four things promised from this technology, namely (1) learning management; (2) the engagement of students in learning; (3) assessment of learning and (4) distance learning. In fact the development of learning models involving computer technology so far only fulfill aspects of the content, and assessment in the form of interactive exercises. It protruding from learning with computer tools is the display of various images, graphics and animation. Views like this has been recognized a number of researchers were able to induce the joyful learning of students (Overfield & Bryan-Lluka, 2003; Gunn & Pitt, 2003; White et al., 2002).

The research involves the use of a computer as an agent of learning technology has demonstrated something very valuable in teaching and learning. Overfield and Bryan-Lluka (2003) found that computer-based learning (CBL) for Haemostasis topic has given pleasure and interest in learning the students on the topic. However, the learning aspect is not sufficiently attractive in terms of whether or not the teaching materials were presented. Another thing that should be considered when teachers or lecturers will prepare instructional materials is the aspect of pedagogy. Teaching materials in the form of modules are presented through websites in a package of e-learning or e-teaching as a
Virtual Learning Environment (VLE) is often poor aspects of pedagogy and educational values (Badge, et al., 2005).

Keppel, et al. (2001) tested the model of Problem-Based Learning (PBL) and Self-Directed Learning (SDL) to address the problem of poor aspect of pedagogy. Suryadi (2010) describes how important a teacher when planning learning to pay attention to the teacher-student relationship and the relationship student-teaching materials that will occur during the learning. According to Suryadi (2010) the teacher-student relationship (pedagogic) should be able to create a didactical situation to enable the situation in the student learning process (learning situation). Suryadi findings were based on the results of research and literature review can be used as a guide in planning a lesson or lecture, including learning or lectures which use information technology.

Mishra and Kohler (2009) stressed that the technology, pedagogy and content (subject material) (TPACK) is a frame of mind that must be considered in integrating technology in learning as TPACK will connect technology into the curriculum, teaching materials and pedagogical approaches. Within the framework of TPACK according to Mishra & Kohler (2009), there are three components of the knowledge of teachers (teacher's knowledge) are interrelated: Knowledge Teaching materials (PMA), Knowledge Pedagogy (PP) and Science Technology (PT) as shown in Figure 1.

![Figure 1. Relationship Between TPACK Components (Mishra & Koehler, 2009)](image)

**RESEARCH METHODOLOGY**

Descriptive study was conducted to 40 students of Biology Education who attending genetics courses. The study was conducted in four phases. The first phase is the analysis of the subject matter of genetic course. The second phase is the identification of the software as a component of the technology that will be integrated. The third phase is to determine the delivery strategy of teaching materials as pedagogy aspect. The fourth phases is the phase of tryout. The piloting phase conducted on students who conduct genetics course. The format of the subject matter characteristic analysis, identification technology devices and instruments for assessing learning process used to collect data in this study. Subject matter of the course are limited to genetics substances of heredity. The technology implemented is information and communication technology (ICT) in the form of software Moodle as manager of the lecturing system (Learning Management System).

**RESULTS AND DISCUSSION**
Each section or topics of genetics subject matter have certain characteristics. Characteristics of each topic probably similar or different depending to the concept or its contents. For example, the Mendelian genetics and heredity substance having similar characteristics in terms of abstractness concepts. But the level of abstraction heredititas substance is much higher than the abstractness of Mendelian genetics. White (1994) revealed that the contents of science has different characteristics between one concept to another concept. Some of the characteristics mentioned for example the relationship with the general phenomenon, the level of abstraction, complexity, content of common words or particular, any mixture of knowledge, and linkages with other topics. The results of content analysis to genetica subject matter based on the dimensions of contents (White, 1994) presented in Table 1.

**Table 1. Characteristics of Topics Lecturing in Genetic Course based-on Content Dimension**

<table>
<thead>
<tr>
<th>No</th>
<th>Topics</th>
<th>Dimension of contents</th>
<th>Related to common phenomenon</th>
<th>Abstractness</th>
<th>Complexity</th>
<th>Content of common or particular words</th>
<th>Any mixture knowledge</th>
<th>Related to other topics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mendelian Genetics</td>
<td></td>
<td>++</td>
<td>+</td>
<td>-</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td>Heredity substances</td>
<td></td>
<td>-</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>3</td>
<td>Microbe genetics</td>
<td></td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>++</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td>Population genetics</td>
<td></td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>++</td>
<td>++</td>
</tr>
</tbody>
</table>

Legend:  
- = No or little  
+ = No  
++ = There are many  
+++ = No aplenty

Based on Table 1 it appears that each subject in genetics subject matter has various content dimensions. The concepts of Mendelian genetics contains much relevance to a common phenomenon. A common phenomenon include "any living thing can produce offspring or children", "descendant or child has similarities with the mother nature", "marriage between two individuals of different nature" and so on. The subject also has the abstractness of the concepts, for example "allele", "genotype", "homozygous" and others. The complexity of the subject matter is relatively less for mendelian topic if compared to other topics. But, the content of common or particular words of Mendelian genetics quite a lot, for example to the words of a general nature "offspring", "dominant", "gamete", "matting" and others. Mendelian genetics also has special words such as "alleles", "recessive", "genotype", "phenotype", "filial", "parental", "segregation" and others. The presence of a mixture of knowledge reflected when estimating to ratio of phenotypic trait variation or a result of a matting, in this case the necessary knowledge is theoretical or mathematical possibility. The subject also have relevance to other topics in genetics, for example, when discussing the concept of alleles will be related to the concept of genes, chromatin and chromosome that will be discussed on substance of heredity.

The topic of substance of heredity is less relevance to common phenomenon. This is due to only a fraction of the concepts contained therein which are directly observable. For
example, chromosomes can be observed through microscopic preparations, even though not everyone can observe it. The phenomenon of gender determined by the sexes chromosomes inherited from the parents, many people already knew it. But the peoples understanding of the phenomenon is different to the phenomenon that a child has similarities with parents or brathers. Thus the phenomena belong to the substance of heredity less common phenomenon among the people. The topic of heredity substance consists of several sub topic or main concepts such as chromosomes, nucleic acids, replication, transcription, translation and mutation. Each sub topic or main concept contains a number of concepts. The topic has high level concepts abstractness. For example on discussing the chromosomes will be studied about the formation of chromosomes during cell reproduction. The process is relatively abstract, because to discuss it requires an understanding of "chromatin", "nucleosome", "DNA", "protein" and others. Similarly to the other sub topics have a higher abstraction. When discussing the replication, transcription and translation almost all concepts related to the topic is abstract. In addition to having a high level of abstraction that is the subject of heredity substance also have very high complexity. This subject also contains abundance specific/particular words, but instead the words "general" it is very limited. Examples for common words is based on the popular knowledge of a peoples condition at this time is the "gene", "chromosome" and "DNA" can be considered as common words. The example of the words "particular" such as "double helix structure", "nucleotide", "replication", "transcription", "translation", "DNA polymerase" and others. In order to understand the subject substance of heredity necessary knowledge or understanding of the relevance concepts. The relevance concepts, to heredity substance is a concepts of chemistry, because the substance of Heredity describe about chemical mechanism that occurs in the living thing. These reasons caused the subject has the dimensions of a mixture of high knowledge. This subject also has lot of connection to other topics, such as Mendelian genetics in the context of gene expression will be associated when discussion about the phenotype. The topic also related to microbial genetics in the discussion of the structure of DNA, the DNA is linear and circular. Related to population genetics, for example, on discussing about gene mutations with changes in gene frequency.

The topic of microbial genetics contain concepts related to the structure of the microbial substance of heredity, modification of heredity substance, mechanisms of gene expression in bacteria and their role in human life. The microbial genetics topic exist with has concept related to a general phenomenon, for example when discussing about genes that involve a role in producing antibiotics, or when discussing "cancer" is caused by a virus. In addition this topic has a high level of abstraction. Some examples of concepts that include abstract contained on this subject "plasmid", "vector", "mini-chromosome" "transposon", "transduction".

From the dimensions of complexity, the microbial genetics is quite complex because there is a lot of complexity biological process, such as, the process of transfer of genetic material from one bacterium to another. This complexity is apparent in the discussion of the process of DNA recombination and viral reproduction process in bacteria. Besides having a high complexity, the topic contains the words of general and specific enough. For example, for the common words "bacteria", "virus", "cancer", "antibiotic". Also for specific words such as "plasmid", "transduction", "transposon".

In addition to the dimensions of the contents described above, the subject of microbial genetics relates to a mixture of knowledge and their linkages with other topics. Knowledge mixture contained in microbial genetics, among others, relate to physiology illness due to infection, the mechanisms of cancer and others. In terms of linkages with other topics, such as when discussing gene expression, mutation and recombination.
The subject of population genetics have all dimensions of the contents, but the strength is not too high. Dimensions prominent is the abstractness, the mix of knowledge and linkages with other topics. For the dimensions of relevance to a common phenomenon found when discussing the concept of "population" (the population of the Sundanese, Javanese population, the population of Sumatra, etc.). Abstract concepts in the topic of population genetics is similar to Mendelian genetics, for example, "allele", "genotype", "homozygous" and "heterozygous". Dimension of complexity to this subject is in relation to the mathematical calculations to calculate gene frequencies. It indicates also that the subject of population genetics has a mixture of knowledge.

Based on the analysis of the four parts of the subject matter of genetics course is based on the dimensions of the contents according to White (1994), it is known that the substance of heredity is the most complex subject. It is therefore not surprising that the findings of the research showed that this part is considered difficult both to students as well as biology teacher (Widodo, et al., 2006; Dogru-Atay & Tekkaya, 2008). This facs is the reason for considering to choice those topics as a sample to development the lecturing systems that combine contents, pedadogy and technology (TPACK) on genetics course.

The study also analyzes the concepts belong to the substance of heredity. Analysis of the concept is a strategy to help teachers in planning learning sequences for the attainment of the concept (Dahar, 1989). Many aspects must be considered when conduct concepts analysis, every concept analyzed should consists of concept label, concepts attribute, definitions of concepts, relationships among concepts, examples and non-examples. The analysis procedure has been done following the procedure of Herron (1977) and Liliasari (1995). Results of analysis of the concept to the concepts contained in the subject substance of heredity are presented in Table 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Concept type</th>
<th>Amount</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Concrete</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>abstract</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>3</td>
<td>Concept by principle</td>
<td>59</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Total amount</td>
<td>93</td>
<td>100</td>
</tr>
</tbody>
</table>

Based on Table 2 can be explained that the concepts contained in the topic of heredity substance largely consist of the type of abstract, and concepts are formed by principle. Both types of these concepts generally to reveal through the acceptance of the concept rather than through establishment. To receive these kinds of concepts, one must be able to connect these concepts to existing knowledge in cognitive structure (Ausubel, Novak & Hanesian, 1968) if not, then the concepts that will be accepted as rote.

The findings indicate the notion of the students and teachers that the topic of heredity substance is difficult. The difficulty is possible because the types of concepts are mostly abstract or formed based on the principle concepts, so maybe this time the students just memorize concepts without interpret. To overcome this need to develop a genetic learning patterns that can solve learning difficulties genetics over the years.

The next phase is analyzing of technological components that will be integrated to the content knowledge and pedagogical knowledge. The technology is the information and communication technology (ICT). The reason for choosing this technology is closeness in which communication is an important factor in the learning process. Analysis of the software focus on characteristics of technology components. Teachers should have the capacity of technological knowledge that is sufficient to technology that is integrated into the teaching and learning can function optimally. In this study, the selected software is Moodle. Moodle has a number of advantages as the manager of virtual learning. Results of
the analysis has been conducted on Moodle as a learning manager (Learning Management System or Course Management System LMS / CMS) are presented in Table 3.

Table 3. Characteristics of ICT (Software LMS MOODLE)

<table>
<thead>
<tr>
<th>No</th>
<th>Aspects</th>
<th>Analysis Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Availability</td>
<td>Widely use in schools/university</td>
</tr>
<tr>
<td>2</td>
<td>Budgetting</td>
<td>Open source</td>
</tr>
<tr>
<td>3</td>
<td>Fitur and menu</td>
<td>Simple, flexible, depending to user</td>
</tr>
<tr>
<td>4</td>
<td>Accessability</td>
<td>Connecting to the internet, easy to use every time and any where</td>
</tr>
<tr>
<td>5</td>
<td>Availability of interaction facility</td>
<td>Discussion forum, SMS, email</td>
</tr>
<tr>
<td>6</td>
<td>Students activities controlling</td>
<td>Controlling by time regulation</td>
</tr>
<tr>
<td>7</td>
<td>Assessement facility</td>
<td>Available online assesement and asignment</td>
</tr>
<tr>
<td>8</td>
<td>Source for students learning</td>
<td>Formulated by teacher/lecturer</td>
</tr>
</tbody>
</table>

The aspect must be understood from the LMS according to Mallon, et al. (2009) is the appearance and capabilities of the system. Display and system capabilities encompasses aspects administration, learning management, reporting and measurement, security, human resource realtionship, integration of content, the content management. Administrating the basic features which include lectures registration management, scheduling and management of the course catalog. More advanced features include the management taking prerequisite courses, credits courses, processing certification and the deadline for college. Learning management includes managing assesemen, scores of students, lesson planning, course of lectures, and search capabilities. Reporting and measurement, the most basic features include recording and reporting of certification and learning metrics. More advanced features include exception reporting, notification deadline itself automatically. Security, the provision of different access rights based on organizational hierarchy, domain or role, encryption of data and personal information. The linkage of human resources, basic features include synchronization with database penggorganisasian human resources. Content management, storage of the contents of the basic features include online learning materials and an index of contents for tracking. More advanced features include content management and workflow among the various groups.

One of the open source LMS that is currently widely used as a virtual learning management software is the Modular Object-Oriented Dynamic Learning Environment (Moodle). The software Moodle has a number of advantages as a manager of learning. These advantages, especially in terms of the availability of interaction between teachers and learners and the interaction among fellow learners. Interactions related to the context of teaching and learning can take place either synchronously or asynchronuos. The feedback obtained from the test results showed that 90% Moodle faculty and students assume that the performance of the software Moodle above average or very good compared with other LMS (Petherbridge, 2008). Besides the lecturers and students also agree and strongly agree that Moodle is easier to use compared to Blackboar Vista / WebCT.

Based on the result of TPCK components analysis have developing genetic lecturing system that integrates ICT into teaching and learning context. The learning process is online. The software application in genetic Moodle has enabled the functioning of the processes of pedagogical and didactic online virtual learning process.
CONCLUSION

The structure of genetic lecturing that has been developed which integrate the three components of TPACK is characteristic of the subject matter (content), online teaching and learning process (pedagogy) and ICT-based Moodle (technology). The component of the GeneTIK is controlling students’ learning activities i.e discussion forums, online assessment has controlled and monitored student learning progress independently. Subject matter of the course is associated (linked) with websites provide online subject matter. Websites that intentionally by lecturers linking to course content that has a variety of explanations concept in form of text, images and animations. GeneTIK provide more than one device supporting the lecturing online activities.

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The Content of Chlorophyll, Chromium and Enzyme Activity of Catalase (CAT) and Ascorbate Peroxidase (APX) on Banana Plantlets \textit{(Musa paradisiaca)} cv. Nangka in Chromium Stress Condition

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**Article info**

**Abstract**

Heavy metals are found in almost all types of industrial waste, such as the tannery wastes containing chromium (Cr). In plants, Cr can cause damage to DNA, proteins, photosynthetic pigments, chloroplast ultrastructure and cell membranes, so as to inhibit germination, photosynthesis, respiration, cell division and growth, resulting in lower yields. Plant response to Cr stress can vary; therefore, we investigated the response of banana plantlets \textit{(Musa paradisiaca)} cv. Nangka to stress Cr. In this study, banana plantlets grown in vitro on medium with Cr 0, 50, 100, 200 and 400 ppm. The results showed that the content of chlorophyll increased to a concentration of 50 ppm, and then decreased at higher concentrations. Cr content of the root and shoot the greater with increasing Cr in the medium and higher in the roots than in the shoots. CAT and APX enzyme activity is higher in the roots than in the shoots.

**INTRODUCTION**

Many industrial waste containing heavy metals, such as Chromium (Cr). Tanning industry is one industry that uses material tanner containing heavy metals Cr. Waste is directly dumped without prior treatment and will certainly lead to contamination of water and soil in the vicinity. The content of Cr in the contaminated soil reaches an average of 200 ppm, even more than 200 ppm (Ririn, 2009; Diwan \textit{et al.}, 2010), while the soil quality standard for the content of Cr, amounting to 76 ppm (US-EPA, 2004, in Andarani \\& Roosmini, 2010).

Various disorders can arise when Cr into the plant body. Toxic Effect of Cr in plants includes interference of the process of germination, growth of roots, stems and leaves that can impact the total dry matter production and yield. It also directly influences the enzymes or other metabolites (Shanker \textit{et al.}, 2005).

From the research results can be known that Cr may cause a reduction in the rate of photosynthesis, due to a reduction in the chlorophyll content of \textit{Vigna mungo} (Hussain \textit{et al.}, 2006), \textit{Triticum aesticum} (Subrahmanyam, 2008), \textit{Pisum sativum} (Pandey \textit{et al.}, 2009), \textit{Brassica juncea} (Ghani, 2011; Diwan \textit{et al.}, 2012), \textit{Sorghum bicolor} (Revathi \textit{et al.}, 2011) and \textit{Hordeum vulgare} (Yildiz, \textit{et al.}, 2012).

Such defects can be caused by Cr which damage DNA, proteins, photosynthetic pigments, and chloroplast ultrastructure of cell membranes, which finally inhibit germination, the process of photosynthesis, respiration, cell division and eventually disturbed the growth (Panda and Choudhury, 2005).
Proceeding
International Seminar on Mathematics, Science, and Computer Science Education

Hossain et al. (2012) explained that in general heavy metal ions that exist in the root zone will compete with essential metal ions, which can lead to deficiency of essential metal ions and heavy metal ion excess. This will lead to heavy metal ions bind to proteins, DNA or other targets such as -SH groups and -COO⁻ and can cause malfunctions of proteins and DNA or changes in enzyme activity. They ultimately lead to metabolic disorders such as inhibition of photosynthesis and plant respiration will lead to an increase in Reactive Oxygen Species (ROS) and cause oxidative stress.

Oxidative stress is caused by an increase in Reactive Oxygen Species (ROS), such as H₂O₂, O₂⁻, OH⁻ (as a side product in a number of metabolic reactions in the cell organelles) exceeds the amount of antioxidants produced. Antioxidants can be either enzymes or non-enzymes. Antioxidant enzymes are catalase, glutathione reductase, ascorbate peroxidase and superoxide dismutase. Antioxidant non-enzymes are proline, ascorbic acid, glutathione, carotenoids and flavonoids (Azmat et al., 2009).

In normal conditions, the production of ROS in cells is small quantity and controlled. Heavy metal toxicity can increase ROS production more than 30-fold (Mittler, 2002). ROS react with a variety of fats, proteins, pigments, nucleic acids and cause lipid peroxidation, membrane damage and inactivity of enzymes, thus affecting cell viability (Diwan et al., 2010). One of the important processes is disrupted due to an increase in ROS is the reduction in the rate of photosynthesis in various plant species. This is because the chloroplast is an important target in oxidative stress (Pandey et al., 2009).

Therefore, because the response of plants to heavy metals varies, then this research investigated how the content of chlorophyll, chromium and enzyme activity of Catalase (CAT) and Ascorbate Peroxidase (APX) on banana plantlets (Musa paradisiaca) cv. Nangka in Chromium stress condition.

MATERIAL AND METHODS

Banana plantlets in-vitro culture. In this research, we used the plantlets of banana plants (Musa paradisiaca) cv. Nangka in-vitro culture. Plantlets were obtained through the stages of initiation and multiplication of shoot apex culture banana plants derived from Cr contaminated land. Completely randomized design (CRD) was employed in this experiment. Cr concentration in the growing medium, i.e. 0 ppm, 50 ppm, 100 ppm, 200 ppm and 400 ppm. The selection of concentrations was based on the concentrations commonly found in soil contaminated by Cr (Diwan et al., 2010). Sources of Cr used are K₂Cr₂O₇ added to the basic MS medium (Murashige and Skoog). Each treatment was repeated 10 times, so that the number of research units was 5 x 10 = 50 banana plants in a culture bottles. All cultures were maintained in an incubation chamber in 25-28 °C and in a TL 1000 Lux light irradiation for 12 hours per day. Maintenance was performed during 6 weeks.

Chlorofil content of the banana planlets. Chlorophyll content was measured spectrophotometrically based method Arnon (1949, in Suyitno, 2010).

Cr content of the banana plant. Cr content of the various organs of the banana plant (root and shoot) was measured by the method of concentrating the sample with concentrated nitric acid (HNO₃) at 300 °C for 1 hour (Liu et al., 2009). Sample was analyzed by using Atomic Absorption Spectrometer (AAS).

Enzym activity of CAT and APX. CAT enzyme activity was measured by monitoring the disappearance of H₂O₂ in absorbance 240 nm (Aebi, 1984, in Diwan et al., 2010). APX enzyme activity is measured by the rate of oxidation of ascorbic based methods Nakano and Asada (1981).
Statistical Analysis. All parameters were analyzed by considering homogeneity with Bartlett test. If the result is homogeneous, it is followed by analysis of variance (ANOVA) of the track on the real level (α) of 0.05. Statistical analysis was examined using SPSS 18 Software.

RESULTS AND DISCUSSION

The content of chlorophyll in banana plantlets can be seen in Figure 1. The content of chlorophyll at a concentration of 50 ppm higher than the control, while at 400 ppm showed the lowest value. However, from the results of statistical tests, the difference was not significant, although there is a tendency of the higher Cr concentration in medium the lower chlorophyll content of banana plantlets (Musa paradisiaca) cv. Nangka. Thus we can see that the Cr decrease the chlorophyll content of banana plantlets (Musa paradisiaca) cv. Nangka.

Cr can impact various processes in the plant body, which was in the process of photosynthesis occurred among electron transfer inhibition, inactivation of the Calvin cycle enzymes, reducing CO₂ fixation and disorganization of the chloroplasts (Shanker et al., 2005). Treatment of various studies with Cr could be seen that all the disturbances arising, caused by Cr influential in the production of Reactive Oxygen Species (ROS) that cause oxidative stress (Shanker et al., 2005; Panda and Choudhury, 2005; Subrahmanyam, 2008; Pandey et al., 2009; Yildiz et al., 2012). ROS reacts with a variety of fats, proteins, pigments, nucleic acids and cause lipid peroxidation, membrane damage and inactivity of enzymes, thus it impact cell viability (Diwan et al., 2010).

![Figure 1. The content of chlorophyll in banana plantlets (Musa paradisiaca) cv. Nangka, 6 weeks after treatment (mg/L).](image-url)
The content of Cr in the roots of banana cv. Nangka is higher than those in shoots. In a medium in a concentration of Cr 400 ppm, Cr content in the roots of 9 times is higher than at the shoot (Figure 2). In addition the results of previous research on various plants generally show the similarities. For example, at the *Leersia hexandra* Swartz Cr accumulated on the walls of root cells (Zhang *et al.*, 2009; Liu *et al.*, 2009). Oliveira (2012) also concluded that the Cr mainly accumulated in the roots, little is translocated to the leaves. It is put forward based on the results of research on *Lolium perenne* that the roots accumulated Cr 10 times more than the leaves; research results on some types of vegetables that can be known that Cr is running very slow translocation and accumulation in roots 100 times higher than the shoots; research results in bean seed found that only 0.1% Cr accumulation, whereas at the root of 98% and the results on *Amaranthus viridis* and *Brassica oleracea* is known that Cr accumulated mainly in the roots.

Plants have three basic strategies for protecting the body from the effects of toxic heavy metals, which become: (1) Excluder (heavy metals in the body is lower than its surroundings), (2) Indicator (heavy metals in the body the same as in the environment) and (3) Hyperaccumulator (heavy metals in the body more higher than its surroundings) (Mohanty & Patra, 2011). When considering these criteria, we can see that the banana plant cv. Nangka includes heavy metals hyperaccumulator. Singh *et al.* (2013) divides hyperaccumulator plants into four groups, namely: low hyperaccumulator (1000 to 2000 mg/Kg), moderate hyperaccumulator (2000-3000 mg/Kg), hight hyperaccumulator (3000-5000 mg/kg) and very hight hyperaccumulator (more than 5000 mg/Kg). Although the banana plant cv. Nangka includes hight hyperaccumulator plants, but only accumulated in the roots. So that is translocated to the shoot about 10-24%.

**Figure 3.** CAT and APX enzyme activity in roots and shoots banana plantlets (*Musa paradisiaca*) cv. Nangka, 6 weeks after treatment (EU/mg protein).

CAT and APX enzyme activity can be seen in Figure 3. At the same concentration, there is a tendency CAT and APX enzyme activity in roots was higher than at shoots, although the results of statistical tests showed no significant difference. Produces antioxidant enzymes as a defense mechanism to detoxify heavy metals in plants (Diwan *et al.*, 2010). As in *Hordeum vulgare* L. plant that is tolerant, the enzyme activity of SOD, POD, CAT and APX increased with increasing concentrations of Cr in the medium (Yildiz *et al.*, 2012). Likewise on *Triticum aesticum* L. increased enzyme activity of SOD and
CAT (Subrahmanyan, 2008). Increased activity of this enzyme because of the accumulation of Cr, especially in the root area, so that the necessary antioxidants to cope with oxidative stress caused by Cr.

CONCLUSION

Based on the results of the study above we can be summarized as follows: (1) The content of chlorophyll increased to a concentration of 50 ppm, and then decreased at higher concentrations. (2) Cr content of the root and shoot the greater with increasing Cr in the medium and higher in the roots than in the shoots. (3) CAT and APX enzyme activity is higher in the roots than in the shoots.

REFERENCES


Ectoparasites Identification on Chicken in Desa Bojongsalam
Kecamatan Rancaekek Kabupaten Bandung

Yayan Sanjaya, Any Aryani, Suhara and Mira Puja Lestari

Article info

Keywords:
Chicken ectoparasite, Lipeurus caponis, Menopon gallinae, Menacanthus stramineus, Goniocotes gallinae, Dermanyssus gallinae

Abstract

Ectoparasite at chicken generally do not inflict death but economically can disadvantage. The existence of ectoparasite in animal body can cause loss very diverse. In the region of Bandung regency own there has been no research on the ectoparasite so required a research. The aims of this research to identify ectoparasite that infects purebred chicken in the village of Bojongsalam, sub-district Rancaekek, Bandung regency. Research was conducted from March until May 2013. The scope of research were the measurement of environmental conditions, the sample chicken, the sample ectoparasite, making preparat ectoparasite, identification ectoparasite, and analysis of data. A chicken used in penilitian is broiler and chicken laying in the village of Bojongsalam. Based on the results of research conducted, the identification ectoparasite demonstrating an absence of five of a kind that was discovered in a chicken race of the laying. The fifth species ectoparasite was Lipeurus caponis, Menopon gallinae, Menacanthus stramineus, Goniocotes gallinae, and Dermanyssus gallinae. From the five species ectoparasite are found, Lipeurus caponis the most frequently found with the percentage domination of 63,6%, while ectoparasite the fewest found, that is of Dermanyssus gallinae with the percentage dominance of 0,26%. Different with chicken laying, in a broiler not found the existence of ectoparasite. It was related to the sanitary at home as well as the existence of bristles on broiler.

Corresponding Author:

INTRODUCTION

Chicken is a source of protein that has an important role in human. Based on analysis of nutritional value, every 100 grams of chicken meat contains 74% water, 22% protein, 13% calcium, 190 mg of phosphorus, and 1.5 mg of iron (wijaya, 2008). The number of ectoparasites that attack animal body parts can be harmful to farmers. On the other hand the need eggs and meat that is high enough to increase from day to day. Due to this, it is important to diagnose since the beginning of an infected animal ectoparasites. This can be done to prevent the animals from being infected ectoparasites and determine the existence and type of ectoparasites that attack the animal.

Ectoparasites, especially fleas can become the main enemy for farmers who raise chickens in cages management conditions are less baik. Reseach about ectoparasites on chicken, in the district of Bandung itself has not been done.

EXPERIMENTAL METHODS

Research was conducted in between March – May 2013 at Desa Bojongsalam, Kecamatan Rancaekek, Kabupaten Bandung.

Procedure

Ectoparasites samples on chicken
The sample used in this study is on chickens (aged 6 months and over) samples were used respectively as many as 15 chickens. Sampling ectoparasites done using sampling methods ectoparasites manually according Upik & Susi (2010).

![Figure 1](image). Chicken’s body region (area of sampling) (1-6: head, neck, foot, back, chest, tail)

Ectoparasites retrieval is done by using a cotton swab moistened with 70% alcohol and tweezers. Cotton that has been moistened with 70% alcohol and then applied to the body if it appears there ectoparasites chicken crossed the area. It is intended that ectoparasites on chicken body is easy to obtain and collected, while the tweezers used as a tool to take ectoparasites attached to the chicken body. Intake of ectoparasites done carefully so as not to damage the specimen to be taken to the sample dikoleksi. Selanjutnya Structures Laboratory Animals, Department of Biology Education, FPMIPA, University of Indonesia to be observed using a microscope and the results didokumentasikan. Pengukuran environmental conditions surrounding the cage performed before sampling chicken, Measured environmental conditions are humidity, temperature and light intensity.

**RESULTS AND DISCUSSION**

Based on the results of research on ectoparasites on broilers (laying hens and broilers) in the village Bojongsalam, found as many as five species of ectoparasites of three families (Philopteridae, Menopoondae, and Dermanyssidae), where five of these species are *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus stramineus*, *Goniocotes gallinae*, and *Dermanyssus gallinae*.

**Dominance ectoparasites on Chicken**

The identification results ectoparasites done in laying hens obtained five species of ectoparasites that consists of *Lipeurus caponis*, *Menopon gallinae*, *Menacanthus stramineus*, *Goniocotes gallinae*, and *Dermanyssus gallinae*. The fifth type of ektoprasit were obtained from 15 samples collected laying hens and subsequent identification of the presence ektoparasisnya. Based on this research, it is known that 15 on chickens were identified where ektoprasitnya, chicken 100% of infected ectoparasites (Table 2).

<table>
<thead>
<tr>
<th>Ectoparasites</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lipeurus caponis</em></td>
<td>63,6</td>
</tr>
<tr>
<td><em>Menopon gallinae</em></td>
<td>19,54</td>
</tr>
</tbody>
</table>

**Table 2. Domination ectoparasites on chicken (%)**
Based on the research conducted, the five types of ectoparasites were found to obtain a percentage value that is different. Lice Lipurus caponis is ectoparasit most infect chickens with the dominance percentage of 63.6%, while fleas Menopon gallinae has a percentage value below Lipurus but higher infestation of fleas Menacanthus and Goniocotes, which obtained a percentage of 19.54%. Ticks Menacanthus have dominance percentage of 15.24%. Lice infestation Goniocotes gallinae is the least affecting chickens, which obtained a percentage of 1.36%. Among the five ectoparasites found, the mites are the least ectoparasites infecting chickens, compared with flea ectoparasites. Dermanyssus gallinae mites dominanansi has the smallest percentage (0.26%).

### Distribution of ectoparasites on the body on the chicken

At research done, for taking ectoparasites on the chicken is not done arbitrarily, but performed on several body parts among which are the chicken on the head, neck, chest, back, tail, and legs. Based on this research, ectoparasites spread to all parts of the chicken body. But the presence of ectoparasites on each chicken's body is different according to the type ectoparasitnya. Among the rest of the body chicken, Lipurus caponis species are ectoparasites which dominates the area between the heads of other ectoparasites species, the result amounted to 93.54% (Table 4.3). Among the species found Menopon gallinae, the species most commonly found in the back area, compared to other chicken body parts, which is equal to 33.19% of the fleas are in the back area.

<table>
<thead>
<tr>
<th>Ectoparasites</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Menacanthus stramineus</td>
<td>15.24</td>
</tr>
<tr>
<td>Goniocotes gallinae</td>
<td>1.36</td>
</tr>
<tr>
<td>Dermanyssus gallinae</td>
<td>0.26</td>
</tr>
</tbody>
</table>

**Table 3. Ectoparasites distribution on chickens (%)**

<table>
<thead>
<tr>
<th>Ectoparasites</th>
<th>Head</th>
<th>neck</th>
<th>back</th>
<th>chest</th>
<th>leg</th>
<th>anal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipurus caponis</td>
<td>93.54</td>
<td>71.96</td>
<td>50.07</td>
<td>61.04</td>
<td>55.47</td>
<td>86.36</td>
</tr>
<tr>
<td>Menopon gallinae</td>
<td>3.22</td>
<td>16.82</td>
<td>33.19</td>
<td>14.41</td>
<td>20.62</td>
<td>5.26</td>
</tr>
<tr>
<td>Menacanthus stramineus</td>
<td>3.22</td>
<td>11.21</td>
<td>15.35</td>
<td>19.01</td>
<td>22.99</td>
<td>7.41</td>
</tr>
<tr>
<td>Goniocotes gallinae</td>
<td>-</td>
<td>-</td>
<td>1.38</td>
<td>3.68</td>
<td>0.91</td>
<td>0.95</td>
</tr>
<tr>
<td>Dermanyssus gallinae</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.84</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Menacanthus stramineus ticks is most that commonly found in the legs of chicken, with the acquisition of 22.99% results. Ticks and mites Goniocotes gallinae different with fleas Lipurus caponis, Menacanthus stramineus, and Menopon gallinae. Ectoparasites are not found in all parts of the chicken body. Goniocotes gallinae infestation is found only in the legs, chest, neck, and tail, with most major seberan namely in the chest area amounted to 3.68%, while the Dermanyssus gallinae mites are found only in the chest area with pesentase of 1.84%.

Based on the results of research conducted on the identification of ectoparasites on chicken done in the village Bojongsalam, Rancaekek subdistrict, Bandung district, the identification result indicates that there are five types of ectoparasites found in chicken kind of laying. The fifth species of ectoparasites is composed of three families (Philopteridae, Menoponidae, and Dermanyssidae), where five of these species are Lipurus caponis, Menopon gallinae, Menacanthus stramineus, Goniocotes gallinae, and

Bandung, October 17th, 2015
*Dermanyssus gallinae*. Based on the five species of ectoparasites, *Lipeurus caponis* most commonly found with a percentage of 63.6% dominance which are found in the head, while ectoparasites least *Dermanyssus gallinae* found that species with the dominance percentage of 0.26% and are only found in the chest. In contrast to the laying hens, at broilers was not found where ektoprasit. This is related to sanitation in the cage as well as the presence of feathers in broilers.

**REFERENCES**

Macrofungal Diversity in Kantuk Indigenous Forests
Sintang Regency of West Kalimantan

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Article info

Abstract

Some macrofungi specimens were collected in Kantuk Indigenous Forest, Sintang Regency West Kalimantan. Identification of macrofungi were carried out in the laboratory using related literature and mycological techniques. As a results of the research, totally 57 species belonging to 26 families and 2 Divisions (Ascomycota and Basidiomycota). 2 family belong to Ascomycota (Sarcoscyphaceae and Xylariaceae). 24 families belong to Basidiomycota (Amanitaceae, Auriculariaceae, Boletaceae, Calostomataceae, Coriolaceae, Cortinariaceae, Fomitopsidaceae, Ganodermataceae, Gloeophyllaceae, Hygrophoraceae, Hymenochaetaceae, Inocybaceae, Marasmiaceae, Meripilaceae, Merulaceae, Mycenaceae, Phleogonaceae, Pleurotaceae, Pluteaceae, Polyporaceae, Russulaceae, Stereaceae, Strophariaceae, and Tricholomataceae).

INTRODUCTION

The wealth of natural biological resources Indonesian forest is the highest in the world. From 25000-30000 species of Flora Malesia (Malaysia, Indonesia, Philippines and Papua), Borneo island has 10,000-15,000 species that consist of 3,000 species of trees, 2,000 species of orchids, ferns, palms, mosses and fungi1. One of the biological resources that are widely used is fungi. Because of climatic conditions with temperature 22.60°C-33.80°C, the average of humidity 85.20% and 48% of solar radiation2, West Kalimantan become a suitable habitat for various flora, thus forming high biodiversity (KEHATI). One of the biodiversity is the macroscopic fungi (macrofungal). More than 70,000 species of fungi have been known for a long time3. Those fungi generally still live wild in the woods, gardens, landscaping, or in the yard. The potential use of fungi in agriculture, forestry, industry, environment, food, and medicinal ingredients is very high.

One area that still has a pristine fungal diversity is Hutan Adat Kantuk (Kantuk Indigenous Forest). According to the Paoh Benua Village Archive, Kantuk Indigenous Forest is located in Dusun Sungai Kantuk, Village Paoh Benua, District Sepauk, Sintang. This forest is designated as indigenous forest by Paoh Benua village regulations No. 01 In 2011, Chapter III Article 3, wich an area of ±351.95 Ha. Geographical position of this forest is at 0 ° 01'8”- 0 ° 01'21” North latitude and 111 ° 18 '9'' - 111 ° 18' 21 “ East longitude 4. Its average air temperature is 25-26°C, soil temperature is 26-27°C, its average humidity is ± 88-90%, and the soil pH is between 5.8 and 6.1. The topography of Kantuk Forest is flat and hilly with domination of tropical rain forests which are waterlogged in some areas. The Physico-chemical conditions and environment of Kantuk Indigenous Forest are very supportive the growth of fungi especially macroscopic fungi. The fungi can grow with optimum pH between 5.5-7.5 and relative humidity of 80-90% 5.

Fungi inventory in Kantuk Indigenous Forest has never been done so far, that is why we can not find the scientific reports about diversity of fungi in this forest. Fungi that...
contained in Kantuk Indigenous Forest may be endemic, so as a prevention, it should be with preserving in the natural habitat (conservation in - situ).

**RESEARCH METHODOLOGY**

Macrofungi mushrooms were collected from Kantuk Indigenous Forest Village Paoh Benua, Kantuk, Sintang District, in September 2014 to March 2015. We used the cruising sampling method with purposive sampling technique. Macroscopic characteristics and the local ethnofungal knowledge of the specimens were recorded and photographs were taken at field. The local consumption of macrofungi and their local names were recorded by interviewing local people. We identified macroscopic fungi using related literatures: *Mushrooms*, A field guide to Australian Fungi, *Mushrooms* (How to Identify and Gather Wild Mushrooms and Other Fungi), *The Book of fungi*, *The Kingdom of fungi*, *Tumbuhan Berguna Indonesia* and several fungi site on the internet.

**RESULTS AND DISCUSSION**

From this research, we obtained 57 species of fungi from 2 divisions and 26 families, which can be seen in Table 1.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Substrates</th>
<th>Weathered wood or dead</th>
<th>Leaf litter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarcoscyphaceae</td>
<td>Cookeina speciosa</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cookeina tricholoma</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Xylariaceae</td>
<td>Daldinia concentria</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Amanitaceae</td>
<td>Amanita inaurata</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amanita vaginata</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Auriculariaceae</td>
<td>Auricularia auricula-juda</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Auricularia delicata</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Boletaceae</td>
<td>Chalciporus piperatus</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Calostomataceae</td>
<td>Calostoma sp</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Coriolaceae</td>
<td>Fomes fomentarius</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Cortinariaceae</td>
<td>Gymnopilus sp</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Fomitopsidaceae</td>
<td>Fomitopsis rosea</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Ganodermataceae</td>
<td>Amauroderma rugosum</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ganoderma applanatum</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ganoderma lucidum</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Gloeophyllaceae</td>
<td>Gloeophyllum sepiarium</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hygrophoraceae</td>
<td>Hygrocybe sp</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Hymenochaetaceae</td>
<td>Hymenochaete rubiginosa</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Inocybaceae</td>
<td>Crepidotus appplanatus</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Marasmiaceae</td>
<td>Gymnopilus dryophilus</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marasmiellus affixus</td>
<td>+</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marasmius rotula</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Microphallus foetidum</td>
<td>-</td>
<td>+</td>
<td></td>
</tr>
<tr>
<td>Meripilaceae</td>
<td>Meripilus giganteus</td>
<td>+</td>
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<td></td>
<td>Rigidoporus microporus</td>
<td>+</td>
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<tr>
<td>Meruliaceae</td>
<td>Cymatoderma elegans</td>
<td>+</td>
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<td></td>
<td>Gloeoporus pannicinctus</td>
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<td>Stereopsis nigripes</td>
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<td>Mycenaceae</td>
<td>Filoboletus manipularis</td>
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<td>Mycena capillaris</td>
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<td>Mycena leaiana</td>
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<td>Mycena sp</td>
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</table>

Table 1. Macrofungal in Kantuk Indigenous Forest Village Paoh Benua Sub-District Sepauk District Sintang

Bandung, October 17th, 2015
Some species of fungi that are found in this study is shown in Figure 1.

![Figure 1.](image)

**Figure 1.** Species of Fungi were Found in Kantuk Indigenous Forest Sintang District (a) Amanita vaginata (b) Auricularia auricula-judae (c) Chalciporus piperatus (d) Calostoma sp (e) Ganoderma applanatum (f) Hymenochaete rubiginosa (g) Gymnopus dryophilus (h) Marasmius rotula (i) Meripilus giganteus (j) Filoboletus manipularis (k) Pleurotus ostreatus (l) Hexagonia papyracea (m) Pycnoporus sanguineus (n) Russula vesca (o) Cookeina tricholoma

Inventory research of macroscopic fungi in Kantuk Indigenous Forest obtained 57 species belonging to 2 divisions and 26 families (Table 1). The division Ascomycota consisted of family Sarcoscyphaceae (2 species) and Xylariaceae (1 species). Moreover the division Basidiomycota consisted of family Amanitaceae (2 species), Auriculariaceae
(2 species), Boletaceae (1 species), Calostomataceae (1 species), Coriolaceae (1 species), Cortinariaceae (1 species), Fomitopsidaceae (1 species), Ganodermataceae (3 species), Gloeophyllaceae (1 species), Hygrophoraceae (1 species), Hymenochaetaceae (1 species), Inocybaceae (1 species), Marasmiaceae (5 species), Meripilaceae (2 species), Meruliaceae (3 species), Mycenaceae (5 species), Phleogenaceae (1 species), Pleurotaceae (1 species), Pluteaceae (1 species), Polyporaceae (13 species), Russulaceae (2 species), Stereaceae (2 species), Strophariaceae (1 species), and Tricholomataceae (2 species).

Family Polyporaceae was the most commonly found. It was because they had fruit body and hard woody structure, so the family Polyporaceae has a good adaptability in different places at different heights with high humidity. Most of fungi grow on dead or decaying wood substrates i.e. 46 types. While the fungi that grow in leaf litter are 11 species.

CONCLUSIONS

As a results of the research, totally 57 species belonging to 26 families and 2 Divisions (Ascomycota and Basidiomycota). 2 family belong to Ascomycota (Sarcoscyphaceae and Xylariaceae). 24 families belong to Basidiomycota (Amanitaceae, Auriculariaceae, Boletaceae, Calostomataceae, Cortinariaceae, Fomitopsidaceae, Ganodermataceae, Gloeophyllaceae, Hygrophoraceae, Hymenochaetaceae, Inocybaceae, Marasmiaceae, Meripilaceae, Meruliaceae, Mycenaceae, Phleogenaceae, Pleurotaceae, Pluteaceae, Polyporaceae, Russulaceae, Stereaceae, Strophariaceae, and Tricholomataceae).

ACKNOWLEDGMENTS

Gratitude to the Ministry of Research, Technology and Higher Education (Grant: Hibah Bersaing Research), which has funded this research.

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Bioethanol Production of Hydrolyzate Sugar of Rice Straw Powder (*Oryza sativa*, Linn.) by Single and Consortium Yeast Cultures

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**Abstract**

In order to reduce the use of fossil fuels, lower CO$_2$ emissions and take advantage of abundant agricultural waste in Indonesia, required the manufacture of fermentation sugar with several stages of the process are then fermented into bioethanol. Firstly, rice straw is dried, then ground with a grinder to obtain straw powder size of 100 mesh. Furthermore, straw powder was treated 3.0M sodium hydroxide (NaOH), followed by treatment of the hemicellulose and cellulose enzymes, produce reducing sugars as much as 18.82 mg/ml. Furthermore, bioethanol conversion value of the highest sugar obtained from the fermentation by a consortium culture of *K.marxianus* and *S.cerevisiae*, of sugar 5% is 1.78% (v/v), and from sugar 10% is 3.48%, at 72th hours . For further research, it is necessary on hydrolysis by various methods using acids, alkalines, enzymes, on lignocellulose substrates and fermentation by various yeasts or bacteria.

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**INTRODUCTION**

Ethanol is used as a 'fuel additive' (a mixture of fuel), it can even replace fuel oil (BBM) conventional. Ethanol in the fuel substitution can significantly reduce oil imports by developing countries, as well as increasing the value of exports from the countries that produce oil, and both of these can strengthen foreign exchange reserves [1]. In Indonesia, the use of bio-ethanol for fuel has been studied since the 1980s, has even made up the level of testing vehicles with premium mixed fuel with bio-ethanol (gasohol). Bio-ethanol is an environmentally friendly fuel, since net of pollutant emissions [10]. The production of bioethanol via fermentation can be divided into three groups, namely sugar, starch and lignocellulose. Origin sugar cane, beet, molasses, fruit can be produced directly into ethanol. Starch from corn, cassava, sweet potato, and sago, must be hydrolyzed beforehand into sugars that are then fermented into ethanol. Lignocellulose from wood, agricultural waste, pulp and paper waste must be hydrolyzed into sugars, mainly through the role of a mineral acid [7, 15].

Fermentation sugar is the raw material that is available abundant relatively and supports industry-based chemical biology. Fermentation sugar can widely be found in agricultural waste, plantation and forestry [5]. Rice (*Oryza sativa*, L) is a main food of Asia, especially Indonesia society. Based on the area of harvested crops in Indonesia, it is known that the amount of rice straw production in Indonesia is 44,229,343 tonnes of dry matter (DM) per year. Of the total waste production amounted to 51,546,297 tons of food crops, approximately 86% is rice straw [3]. The utilization of rice straw is still limited to forage, mushroom growing medium, or burned in the fields to be used as organic fertilizer. Therefore, we want to take advantage of the abundant amount of rice straw as raw material sugar fermentation and fermented into bioethanol. According to studys of Kim and Dale...
[14], the potential of ethanol from rice straw ranges from 0.28 kg / L. Thus, Indonesia is expected to produce ethanol from rice straw around 13 billion liters. Production of fermentation sugar of lignocellulose has been done by using several methods, among others, by [8] by way of pretreatment using 2.0 M sulfuric acid (H₂SO₄) at 90 °C for 60 minutes. The glucose yield was found to be 9.71 g / L. Then, rice straw pretreated with acid was hydrolyzed using 24 mg of cellulase from Trichoderma Resssei ATCC 26 921 over a 72-hour duration, which yielded a total of glucose count of 11.466 g / L. Lignocellulose containing hemicellulose and cellulose. Cellulose can be hydrolyzed to glucose (hexose) using acid, but in this process much glucose is broken (Sirisena et al., 1995). On the other hand, the process of reduction in grain size between 425-75 μm, the lignocellulose such as rice straw can increase glucose production from 43% to 87%, after going through hydrolysis using Aspergillus niger as a producer of cellulase [4].

Due to utilize rice straw into raw materials that have a high economic value, then the rice straw of choice in this study. This study aims to determine the amount of fermentation sugar of rice straw after grinding to the size of 100 Mesh, followed pretreatment using 3.0M sodium hydroxide (NaOH), and hydrolysis using hemicellulase and cellulase enzymes. Furthermore, ferment these sugars by the yeast Saccharomyces cerevisiae and Kluyveromyces marxianus to obtain ethanol.

**MATERIALS AND METHODS**

1) The hydrolysis of rice straw powder: Hydrolysis by alkalines: 10g rice straw powder 100 mesh size, 100ml sterile distilled water was added and 3.0 M NaOH, heated at a temperature of 120°C for 10 minutes. Hydrolysis by hemicellulase and cellulase enzymes: raw material such as rice straw size of 100 mesh and then hydrolyzed using hemicellulase enzyme 0.001g / g; pH.6, t = 270 ', T = 55 ° C, obtained hydrolyzate sugar , subsequent hydrolysis of the enzyme cellulase 0.83 mL/g, pH.4.8; t = 48 hours; T = 60 ° C, enzyme inactivation 100°C, t = 10 '. At this stage, reducing sugar test by DNS methods. Hydrolysis by alkaline-Enzymes: highest sugar of alkaline hydrolysis, followed by enzyme hydrolysis.

2) Fermentation of hydrolyzate Sugar of Rice Straw by singe Culture and mix Culture of S. cerevisiae and K. Marxianus: Microorganisms Culture Propagation Test: Pure culture (S. cerevisiae, and K.marxianus) is takenas 1 loop and inoculated on agar slant (YEPD) and swiped at the surface of the medium. Then incubated at 28°C for 24 hours. Making Starter Fermentation: Pure culture that has only 24 hours of the suspension was made by adding sterile physiological saline in order to be tilted to match the turbidity McFarland turbidity in the solution of 3 (900 x 106 colonies / ml). After the colonies on the agar surface is scraped gently with ose. And as much as 2% (v / v) suspension of microorganisms incorporated into erlenmeyer already containing YEPD medium / YPS Broth. Then incubated (shake-incubation) at 180rpm, the temperature of 30°C, pH. 5.5, for 18 hours for S. cerevisiae, and 14 hours for K. marxianus. Fermentation of hydrolyzate Sugar by Microorganisms: 10% starter inoculum that was created previously incorporated into the fermentation medium containing (per 100 ml): 5% and 10% hydrolyzate sugar, yeast extract 0.5 g, 0.2 g KH₂PO₄, (NH₄ ) 2SO₄ 0.2 g, and 0.1 g peptone (Rouhollah et al., 2007). Then incubated at 30 °C while, for 24-96 hours, pH.5.5.Selama incubation, samples of 12 ml were taken every 6-12 hours for fermentation. Samples were taken and then measured the amount of microorganisms (TPC), pH, a reducing sugar content and concentration of ethanol by HPLC.
RESULTS AND DISCUSSION

A. Hydrolysis of Rice Straw Powder to the Reducing Sugar

Hydrolysis results of rice straw powder using 3.0 M, NaOH, shows that the sugar content obtained from the hydrolysis, which is about 0.67 mg / ml. Hydrolysis results using hemicellulase and cellulase enzymes: raw materials such as rice straw size of 100 mesh and then hydrolyzed using hemicellulase enzyme 0.001g / g; pH.6, t = 270 ', T = 55 ° C, obtained hydrolyzate sugar, subsequent hydrolysis of the enzyme cellulose 0.83 mL / g, pH.4.8; t = 48 hours; T = 60 ° C, enzyme inactivation 100°C, t = 10 '. At this stage the highest sugar content was obtained by 2.12 mg / ml.

Hydrolysis results using a combination of 3.0M,NaOH followed by hydrolysis hemicellulase enzyme 0,001g / g; pH.6, t = 270 ', T = 55 ° C, obtained hydrolyzate sugar, subsequent hydrolysis of the enzyme cellulose 0.83 mL / g, pH.4.8; t = 48 hours; T = 60 ° C, enzyme inactivation 100oC, t = 10 '. At this stage the highest sugar content was obtained by 18.82 mg / ml.

B. Fermentation Hydrolyzate Sugar of Rice Straw

(1). Growth Curve of Microbial

Growth of microbes *K. Marxianus*, showed that the number of cells with the highest sugar content of 5% was obtained at the 36th hours, which is about 8:11 CFU / ml and the sugar content of 10% was obtained at 48th hours with as many as 8:30 CFU / ml. While the test microbe growth of *S. cerevisiae*, indicating that the number of cells with the highest sugar content of 5% was obtained at the 36th hour, which is about 8:30 CFU / ml and the sugar content of 10% was obtained at 48th hours with as many as 8:18 CFU / ml. This can be seen in Figure 1.

![Figure 1. Growth curve of *K.marxianus*, and *S. cerevisiae* CFU/ml.](image)

(2). Reducing Sugar Content During Fermentation

Reducing sugar content during fermentation by a single culture *K.marxianus*, and *S. cerevisiae*, as well as the culture of the consortium are both shown in Figure 2.

![Figure 2. Reducing sugar content during fermentation.](image)
(3). Conversion value of Ethanol Fermentation

The value of ethanol conversion starch hydrolyzate sugars fermented rice straw by the K.marxianus single culture, and S. cerevisiae, as well as the culture of the consortium are both shown in Figure 3. The highest value of the ethanol conversion of starch hydrolyzate sugars fermented rice straw by single culture K.marxianus, of 5% sugar content is 1.70% (v / v) in the hours to 60, and from 10% sugar content was 3.41, up to 72 hours. The highest ethanol conversion value of sugar hydrolyzate fermented by single culture S.cerevisiae, of sugar 5% is 1.37% (v / v) in the up to 48 hours, and from 10% sugar content is 2.19, up to 48 hours. The highest ethanol conversion rate of sugar hydrolyzate is fermented by a consortium culture K.marxianus - S.cerevisiae, of 5% sugar content is 1.78% (v / v) up to 72 hours, and from sugar 10% is 3.48, at 72 hours.

From the results mentioned above, it can be seen that the value of a single culture K.marxianus ethanol conversion is higher than single culture S.cerevisiae, this is in accordance with the opinion of Margaritis and Bajpai, 1982; and Stanbuk, 2003 [9], that K.marxianus is one of the applications more promising some of strain of yeast biotechnology can ferment xylose. Rice straw hydrolyzate sugar of hexose and pentose sugars (one of them, xylose), so that both the sugar is converted into ethanol by K.marxianus. While S.cerevisiae can ferment glucose, can not ferment xylose as xylose reductase and not having xylitol dehydrogenase [9, 11, 13].

Higher ethanol conversion value generated by the consortium culture K.marxianus - S.cerevisiae, Compared with these singular culture, meaning that the two cultures are optimally convert hexose and pentose sugars in rice straw hydrolyzate sugars. Thus, culture consortium K.marxianus - S.cerevisiae, more promising is used in the fermentation and production of ethanol in the future.
CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION

Based on the results of study on Bioethanol Production from hydrolyzate sugar of rice straw powder (*Oryza sativa* Linn) Using Single And Consortium Yeast Cultures, conclusions can be drawn as follows:

1. The highest reducing sugar produced by alkaline-enzyme hydrolysis method of straw rice powder (*Oryza sativa* Linn), as much as 18.82 mg / ml (%).
2. The optimum fermentation conditions, the acquisition value of the conversion highest ethanol at 30 °C, pH 0.5 and sugar content of 10%.
3. The value of the conversion of ethanol from hydrolyzate sugar of rice straw (*Oryza sativa* Linn), the highest obtained from consortium cultures of *K. marxianus* and *S. cerevisiae*, of 5% sugar content is 1.78% (v / v) at 72th hours, and from 10% sugar content is 3.48, on the 72th hours. Then fermented by a single culture *K. marxianus*, of 5% sugar content is 1.70% (v / v) at 60 hours, and the levels of sugar 10% is 3.41, in the last at 72th hours and single culture fermented by *S. cerevisiae*, of 5% sugar content is 1.37% (v / v) at 48th hours, and from 10% sugar content yairu 2.19, on the 48th hours.

RECOMMENDATIONS

1. It should be further research on methods of hydrolysis by using a variety of methods in the paddy straw lignocellulytic materials, to obtain the fermentation of sugar that can be used in various industrial purposes based on biological processes.
2. Culture consortium *K. marxianus - S. cerevisiae*, may be used for the fermentation of sugar hydrolyzate origin lignocellulosic materials such as rice straw. However, further research is needed to test a variety of yeasts and bacteria that are capable of sugar hydrolyzate mengkoncergi origin berlignoselulosa materials into ethanol.

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Process Skill Approaches in Improving Scientific Attitudes and Concept framework Ability of Cell Biology Students of Biology Education Department of Tarbiyah and Teacher Training Faculty at State Islamic University of Sunan Gunung Djati Bandung

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Abstract

The teaching process with process skills should develop a scientific attitude and the high framework on students themselves. The purpose of this study is to identify the different improvement in scientific attitudes and the cognitive intelligence concepts among students who use the process skill approaches and the students who got the conventional lecture. The method used in this study is quasi-experimental method by research design which is used pretest-posttest control group. This study analyzed the effect of treatment already exists and happened naturally which is the data from research result on students of Biology Education department at 6th semester, the research design itself is called as "ex post facto". The results of this study showed significant differences in improvement of the scientific attitude and cognitive intelligence concept between students who got lecturing by process skills approaches and students who got conventional lectures.

INTRODUCTION

Biology Education in Biology Education Department of Mathematics and Science Education Major as the part of the educational system is one process in preparing the quality of Indonesian human resources.

The teaching process by process skills will create the quality students in intellectual and lecture process. In addition Semiawan, et al. (1992: 18) stated that the process of developing skills, students will be able to discover and develop its own facts and concepts as well as to grow and develop all the required potentials.

In accordance with the determination above, the lecture of Cell Biology needs an attempt to be interested implementation, which can motivate students to prepare their selves to study as comprehensive aspect and develop awareness of the importance of the objectives will be reached, so that students can easily take on a deep understanding of what he had learned. Therefore, teachers should be able to determine an appropriate approach in each lecture. Taking into account some decision above, the authors propose a study entitled "Process Skill Approaches in Improving Scientific attitudes and framework of the Cell Biology Concepts of the Students of Biology Education Department of the Tarbiyah and Teacher Training Faculty at State Islamic University of Sunan Gunung Djati Bandung".

Based on the background problems above, the problem will be discussed is as following: "Does the application process skills approach can improve the scientific attitude and concept frameworks of the students of Biology Education Department of the Tarbiyah
and Teacher Training Faculty at State Islamic University of Sunan Gunung Djati Bandung in Cell Biology lectures”.

**RESEARCH METHODS**

The method used in this study is quasi-experimental method. It is used to answer the research questions of students’ scientific attitude and frameworks. The purpose of this study is to implement a lecture approach model of Cell Biology by using experimental methods. The Lecture approach used in this study is the approach skills process. Then the research variables will be measured is the scientific attitude and students’ framework ability. The research design used “pretest-posttest-control-experimental group”, it is the design of pretest control group and posttest control group involves two groups. Those groups are control group and experimental group. In this study, the researcher analyzed the effect of treatment already exists and that has happened according to what (data from the result study on students Cell Biology Education in 2012/2013 academic year has been done). The research above is called as "ex post facto".

The population in this study was students of Biology Education Department, Faculty of Tarbiyah and Teacher Training at 6th semester which consist of two classes. It use simple random sampling in which the class of “B” as the experimental class and the class of “A” as control class. The variable of this research consist independent variables and the dependent variable. The independent variables are Cell Biology lecture using process skills approach. But the dependent variable consist two variables such as scientific attitude and framework ability.

The result of study has been got is quantitative data, in which the data has been got from pretest and posttest. The quantitative data used calculation tool that was used by the computer program SPSS.

a. To test normality gain value both groups the data by the Kolmogorov-Smirnov test.

b. To test the homogeneity of both groups gain value data by Levene test

c. After being tested for normality and homogeneity, as both normal data and then execute homogeneous hypothesis test with t test

**RESULTS AND DISCUSSION**

**RESEARCH RESULT**

1. Test average difference Posttest and N-gain scientific attitude of Cell Biology Experiment Class and Control

Results of t-test post-test scores of scientific attitude Cell Biology experimental and control classes showed that t count for posttest both groups was 6.871 with a significance score of 0.000. Hence the posttest significance score of scientific attitude in Cell Biology 0.000 is less than the real level of 0.05, the consequence of H0 is rejected and H1 is accepted. Thus it can be concluded that there are significant differences between the scientific attitude of Cell Biology experimental group and the control group.

T-test results of scientific attitude value Gain Cell Biology experimental class and control indicates that the N gain scientific attitude Cell Biology, the results of t-test statistical analysis obtained by value t for the N gain both groups was 24 117 with a significance value of 0.000. Due to the significant value of 0.000 is smaller than the real level of 0.05 then H0 is rejected and H1 accepted. Thus, it can be concluded that there are significant differences Cell Biology increase scientific attitude between the experimental group and the control group.
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Figure1. difference Posttest and N-gain scientific attitude of Cell Biology Experiment Class and Control

2. Test different average of Posttest and N-gain concept framework of Cell Biology Experiment Class and Control

Results of t-test scores of posttest framework concept of Cell Biology in experiment class and control indicates that t to posttest both groups was 5.742 with a significance value of 0.000. Hence the significance score of posttest framework concept of Cell Biology is 0.000 less than the real stage of 0.05 then consequence of H0 is rejected H1 is accepted. Thus it can be concluded that there are significant differences between the concept framework of Cell Biology experimental group and control group.

Results of t-test in concept frameworks score of Cell Biology experiments class and control showed that there are significant differences in concept framework of cell biology between experimental group and control group.

Results of t-score N Gain concept framework score of Cell Biology experiments class and control, showed that N Gain concept framework cell biology from statistical analysis of t-test the obtained by score t-count N gain both groups were 9.165 with a significant score of 0.000 is smaller than the real stage of 0.05 so that H0 was rejected and H1 was accepted. It can be concluded that there is significant differences in improvement concept framework of Cell Biology between the experimental group and the control group.

DISCUSSION

1. Student Scientific Attitude

The average of the post-test of capability scientific attitude experimental class is about 79.31 while the average of control class is about 62.18. The average gain of the experimental class is 0.46 and the average gain of control class is 0.16. The average scientific attitude pre-test of students’ cell biology in experimental class and control class from homogeneity test showed that there is no basic ability in experimental class and control class showed the condition the human basic knowledge from the same experimental class and control class. The average of experimental class posttest score is
higher than the average of pretest score. It explains the increase of scientific attitude Cell Biology after conducting lectures using process skills approach or conventional, with a record increase scientific attitude in the experimental group was significantly higher than the control class. The average posttest core and gain experimental class better than the control class, the data is reinforced by the results of scientific attitude t-test and post-test score of N Gain. It showed that the post-test t score for both groups was 6.871 with a significance score of 0.000. Hence the significance posttest score of scientific attitude Cell Biology 0.000 less than the real stage of 0.05 so that H0 is rejected H1 is accepted the consequences. It can be concluded that there are significant differences between the scientific attitude Cell Biology experimental group and control group. It explained that the using of process skills approaches in cell biology lecture especially cell biology subject can improve students’ scientific attitudes than conventional lectures. Thus the human have positive scientific attitude on lecturing by process skill approaches. Students felt that they involve the process of lecturing and contribute their active ideas. It is the same as Suherman’s statement (Citrawati; 2003: 5) stated that in teaching learning process, the educators should strengthen the process of teaching and learning in order that students can find and develop the fact, concept or Principes by their own selves and also create required value and attitude, so that the appropriate approach is the process skills approaches. The teaching learning process by skill process will create the quality students in intellectual development, and having framework competence and the high scientific attitude. It correlates with Semiawan’s statement et al (1992:18) stated that by process development, students will be able to find and develop the fact and concept by their own selves and also create and develop their competence, required value and attitude. Students’ logic capacity on lectures would improve. Students’ needs to study cell biology would improve, it is cause by their method of teaching learning and presenting. Students felt the differences included the provided information.

Figure 2. Different of Posttest and N-gain concept framework of Cell Biology Experiment Class and Control
2. Students’ Concept Framework

The average of students’ concept framework ability in post-test at experimental class is about 74.72 and the average of control class is about 60.13. The average gain of the experimental class is 0.28 and the average gain of control class is 0.14. The average of concept framework pretest of students’ Cell Biology of the experimental class and control from homogeneity test results showed that there is no different ability of early experimental and control classes showed students’ basic knowledge capacity of the experimental class and control class alike. The average of post-test score in experimental class is higher than the average of pretest score. It determined the improvement of the concept framework of Cell Biology after holding lecturing process by using process skills approaches, or conventional skill by a record concept framework on experimental group is higher than control class. The average posttest score and N gain of experimental class is better than the control class, the data is reinforced by the results of the t test concept framework of posttest and N Gain score. It showed that the score of t count on post-test both groups were 5.742 by a significance score of 0.000. Therefore, the score of significant concept framework posttest of Cell Biology 0.000 is less than the real stage of 0.05 so that the consequence of H0 is rejected and H1 is accepted. Thus it can be concluded that there are significant differences between the concept framework of Cell Biology in experimental group and the control group. As the same as Gain N t test results showed that the t score for N gain both groups was 9165 with a significance value of 0.000. Due to the significant score of 0.000 is smaller than the real stage of 0.05 then H0 is rejected and H1 is accepted. Thus it can be concluded that there are significant differences concept framework of Cell Biology improvement between the experimental group and the control group. It showed that the use of process skills approach in the course of Cell Biology, especially in Cell Biology subjects could improve students’ concept framework than conventional lectures. Thus the concept framework of students in the course of Cell Biology improved after implementing the lecture approach process skills. By the approach of process skills, it leaded students to find their own concepts that are fundamental and essential to be mastered. It is in line with Semiawan statement, et al (1992: 18) said that by developing skills process, students will be able to find and develop its own facts and concepts as well as grow and develop required attitudes and values. Approach process skills can develop skills in the process of self-learners to process information or knowledge, find and develop the facts, concepts and principles of science in self-students and apply them to everyday life. According Suwardi (2003: 13) learning mathematics process skills is learning activities that involve different types of mathematical process skills in obtaining, processing and applying the learning outcomes.

CONCLUSION

1. There is a significant difference of scientific attitude improvement between students who received lectures with process skills approaches and students who received regular lectures.
2. There is a significant difference of framework ability improvement between the students who received lecturing by using process skills approach and students who received regular lectures.

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Bandung, October 17th, 2015


