THE EFFECT OF HIGHER ORDER THINKING QUESTION INBIOLOGY PRACTICAL WORKSHEETS TO STUDENTS LEARNING ACHIEVEMENT ON ECOSYSTEM TOPIC GRADE X

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ABSTRACT

The study was aimed to investigate the effect of higher order thinking questionsin biology practical worksheets to students learning achievement on ecosystem topic. The type of the research was quasi experiment and pre-test and post-test were applied. The population of the research is grade X of SMA Negeri 2 Binjai academic year 2015/2016. The samples consist of two groups and were selected randomly, grade X PMS 2 as control group (n=36 students) and X PMS 4 as experiment group (n=36 students). Learning method in both groups was practical. For experimental group, the learning process used the revised-worksheets and the control group used the student's handbook. Multiple choice questions were the instrument to collect the cognitive data and questionnaires were used to assess the psychomotor aspect of the student achievement. Hypothesis was tested by t-test. The post-test result showed that, the average score in experimental group (85.72) was higher than control group (78.61). t_{count} (5.64) > t_{table} (1.994) (with α=0.05 and df=70). The psychomotor assessment revealed that the score of experimental group (90.02) was higher than control group (78.5). t_{count} (7.32) > t_{table} (1.994) (with α=0.05 and df=70). Based on the data from research result used t_{count}> t_{table} then H_0 was rejected and H_a was accepted. It means that there is a significant effect of providing higher order thinking questionsin biology practical worksheets to students learning achievement on ecosystem topic ofgrade X SMA Negeri 2 Binjai academic year 2015/2016.

Keywords: *Practical, Revised-worksheet, Learning Achievement.*

INTRODUCTION

Biology as one field in science study many matters that ask students to think, find out and know the phenomenon and process of science therefore need a method that facilitate student in this learning process. In learning process students play an active role to find the knowledge, concepts, theories and conclusions, not to find the information or facts (Astuti, 2013). Therefore one of activity that can stimulate student to find them in learning process is experiment.

Experiment in Biology use worksheet for a variety of learning needs. It can provide students ways to pull together key data points to evaluate a situation and guide decision-making (Afriyanti, 2011). Worksheets are found useful and practical materials for conceptual understanding if they were effectively used in learning environments(Kurt & Akdeniz, 2002).

The worksheet of SMA in Binjai has been suspected to have several limitations to help both teachers and students to achieve in learning's goal. Generally students in SMA Negeri 2 Binjai are still less active in the learning process especially in practical, so that there are many students who failed the examinations. In assesment of daily exam Grade X IPA SMA Negeri 2 Binjai that not achieve KKM totally 53% students and 47% students not yet to achieve KKM in score 75. Students with learning outcome score achieve in 76-100 around 33% and score in 30-75 around 67%. That why that learning process in X IPA SMA Negeri 2 Binjai still not be effective yet.

Interviews have been conducted, teachers of biology in SMA in Binjaiwere asked to give their opinion about student's worksheet. There was a similar understanding among teachers that the language used in most worksheets

doesnot promote intellectual challenges. Most of the verbs used fall into C1-C3category. This led us to reconsiderhow the worksheet was developed. We want to increase the challenge through modification of questions in the worksheet into critical question and hoped that increased challenge would result in deeper learning, and would correlate to an increase in student learning and performance.Based on problems above, the writer is interested to do research with the title The Effect of Higher Order Thinking Question in Biology Practical Worksheetto Students Learning Outcome on Ecosystem Topic of Grade X SMA Negeri 2 Binjai Academic Year 2015/2016.

THEORITICAL REVIEW

Bloom's Taxonomy was created in 1956 under the leadership of educational psychologist Dr. Benjamin Bloom in order to promote higher forms of thinking in education, such as analyzing and evaluating concepts, processes, procedures, and principles, rather than just remembering facts (rote learning). It is most often used when designing educational, training, and learning processes.The cognitive domain contains aspects of behavior that emphasizes intellectual, such as knowledge, and thinking skills. This includes the recall or recognition of specific facts, procedural patterns, and concepts that serve in the development of intellectual abilities and skills. There are six major categories of cognitive in processes, starting from the simplest to the most complex.

The psychomotor domain containing manipulative behavior that emphasizes function and motor skills / physical ability, swimming, and operating machinery. Itrefers to the use of basic motor skills, coordination, and physical movement. Bloom's research group did not develop in-depth categories of this domain, claiming lack of experience in teaching these skills. These physical behaviors are learned through repetitive practice. A learner's ability to perform these skills is based on precision,speed, distance, and technique (Clark, 1999). Worksheets are materials by which students are given transaction steps regardingwhatthey are supposed to learn. Also, they include activities which give thestudents mainresponsibility in their own learning (Kurt & Akdeniz, 2002).Based on Michaelis and Garcia*in* Toman (2013) stated that worksheets are written materials consisting of individual activities which the students will do while learning a topic and also will enable the students to take responsibility for their own learning with the given process steps related to these activities.

RESEARCH METHOD

The method that used is using random technique sampling.The research is conducted in SMA 2Binjai, Jl. Padang, Binjai, North Sumatera, February-May 2016. The sample taken consists of two classes, which is Class X PMS 2 and Class X PMS 4. To explore the role of the revised worksheet on the student's achievement, 2 groups of students from one school will be selected and conducted for both pre test and post test.

The research was initiated by the activity of observation and interview at schools. Consultation about the problem and other matters regarding the proposal and research were also discussed with the principal and teachers of SMA Negeri 2 Binjai.

After that we must be validated the questions to students. Students were examined for their initial knowledge about the topic. The pre-test will present it and will be conducted before the revised practical worksheet is applied.

The experimental group will be treated with the revision type of worksheet whereas the control group will use the student's guidance book. When the learning process has been completed, both groups of students will be assessed with the same test to see the different results from the pre-test.

The data obtained will be processed through several tests (validity, reliability, item discriminant, item difficulty, normality, homogeinity, and *t* test). Then, the process will proceed to data analysis and discussion.

RESULTS

The result showed that the average pre-test score of experimental group is 57.88 with

the highest score is 73 and the lowest score is 37 (SD = 8.41). The control group showed the score of 54.5 with the highest score is 67 and the lowest score is 40 (SD =8.05).

The post-test result showed that the average of experimental group is 85.72 with the highest score is 93 and the lowest score is 77 (SD = 5.28).The control group has the average score of 78.61, the highest score is 87 and the lowest score is 70 (SD = 5.67).

The psychomotoric average score for experimental group is 91.77 (SD = 6.12).The highest score for psychomotor indicator in experimental group is the ability to perform experiments successfully without supervision (97.22; SD = 7.96). Ability to demonstrate care and respect for the equipment set-up (91.66; SD = 13.36). Ability to organise and perform experiments safely with an awareness of priority in the laboratory (89.58; SD = 15.08) and the lowest score is ability to show engagement in conducting experiments (88.88; SD = 12.59).

The psychomotor average score for control group is lower than its counterpart, the experiment group (76.16; SD = 6.69). When the value was conversed to indicator, the highest score is the ability to demonstrate care and respect for the equipment set-up (81.25; SD = 15.08). The ability to show engagement in conducting experiments (77.77; SD = 16.66). Ability to organize and perform experiments safely with an awareness of priority in the laboratory (76.38; SD = 13.28) and the lowest score is ability to perform experiments successfully without supervision (69.44; SD = 14.77).

The data of pre-test on both groups then was tested using the t-test (two tails). Prior to the t-test, the test of normality and homogenity were also conducted. The results showed that the normality test of the experiment group is: $L_0 = 0.1334$ and $L_{table} = 0.145$. The control group is: $L_0 = 0,0944$ and $L_{table} = 0.145$. Both groups data wasconsidered as normally distributed because the $L_{count} < L_{table}$.

The post-test result showed that the normality test in experiment group is $L_0 = 0.0944$ and $L_{table} = 0.145$. The control group is $L_0 = 0.1064$ and $L_{table} = 0.145$. When the $L_{count} < L_{table}$ for both groups, it can be concluded

that the data of post-test are distributed normally.

The normality test psychomotoric data showed similar trend. The calculation showed that the experiment group has the value of $L_0 = 0.1148$ and $L_{table} = 0.145$. The control groups has the value of $L_0 = 0,123$ and $L_{table} = 0.145$. When the $Lc_{ount} < L_{table}$ for both groups, it can be concluded that the data of psychomotoric are distributed normally.

The homogenity test is used to find out if the data from each group has a homogenous variance or not. The value of $F_{table}(α = 0.05)$ was obtained using the data analysis of Microsoft Excel produced a value of 1.75. Since the F_{count} (1.08) $< F_{table}$ (1.75), it can be concluded the pre-test data is homogeneous.

The value of F_{table} (α = 0.05) was obtained using the Microsoft Excel is 1.75.The calculation of F_{count} is 1.15and since the $F_{count} < F_{table}$ it can be concluded the post-test data is homogeneous.

The value of $F_{table}(α = 0.05)$ was obtained using the Microsoft Excel is 1.75. The calculation of F_{count} is 1.03since the $F_{count} < F_{table}$it can be concluded the psychomotoric data is homogeneous.

DISCUSSIONS

The result of the pre-test in both groups showed similar cognitive achievement (53.5 for the control group and 57.88 for the experiment group). And it was a good start to generalize the achievement for future interpretation about initial circumstances of the students.This fact also suggests that using the questions from the worksheet of the books the school provided was suspected to be the reason. Both scores did not reach the planned KKM settled by the school (73 and 67, for experiment and control group respectively). Although, unexpectedly the result also suggested that the student's of the experiment group did better in the pre-test.

Improving student's performance in the post-test (78.61 and 85.72) were expected. Students were treated differently. Post-test results stated that the student better understood the topic of the ecosystem when they used the revised worksheets.The psychomotor domain is all about doing the

imitating, practicing and habituating skills. In 2002 a colloquy on learning objectives for engineering educationlaboratories agreed that the attributes of psychomotor development should includethe ability to demonstrate competence in the selection, modification and operationof appropriate engineering tools and resources. Student's activity during the learning process was intentionally observed to differentiate the use of the revised worksheet that was designed. The percentage of the difference is11.52%. The experiment group achievement is higher than those in the control group. The average score for experiment group is 90.02 and its counterpart score is 78.5. There is a significant difference of average score between them. The revised worksheet has demonstrated its contribution to put students into engagement to conduct the experiment. Using a more direct and step-by-step procedure, students could perform better in conducting the experiment. They could understand the procedure better that led to have more confidence in the process.

CONCLUSIONS

This research has investigated the contribution of implementing a revisedworksheet (integrating higher order thinking questions) in biology practical to the student's achievement and performance. There is a difference in student's cognitive achievementbetween those students who used the revised worksheet and those who did not use it. The average score of students who usedthe revised worksheets is higher (85.72) than those who used the worksheet from books recommended by the school (78.61) with the percentage difference is 9.04%. While there is a difference also in student's

psychomotoric aspect between those students who used the revised worksheet and those who did not use it. The average score of students who used the revised worksheets is higher(90.02) than those who used the worksheet from books recommended by the school (78.50) with the percentage difference is 14.67%.

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