The Effect of Inquiry Learning Model and Group Investigation Learning Model on Students' Cognitive Skill and Critical Thinking Skill in the Ecosystem Topic at SMA Bhayangkari 1 Medan

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Abstract-This study aimed to determine the effect of learning models on students: (1) cognitive skill and (2) critical thinking skill in the Ecosystem topic at SMA Bhayangkari 1 Medan. The method used is quasi experiment research with a sample of 3 classes randomly determined using cluster random sampling technique. X_1 class was taught by Inquiry Learning model, X_2 class was taught by Group Investigation Learning model, and X_3 class was taught by Conventional model. The test instruments in this study were tests of cognitive abilities in the form of multiple choices, tests of critical thinking skills in the form of essay tests. The data analysis technique used ANACOVA with SPSS 21.0 for Windows program. The results of the study showed that there were influences of learning models on: (1) students cognitive skill ($F = 5.14$, $P = 0.01$) and (2) students critical thinking skill ($F = 63.49$, $P = 0.00$). The students cognitive skill who were taught with Inquiry Learning model (73.75 ± 13.60) were not significantly different from Group Investigation Learning model (77.21 ± 10.69) ($P = 0.47$) and not significantly different from those taught in Conventional model (67.71 ± 11.43) ($P = 0.10$). The students critical thinking skills were taught by the Inquiry Learning model (72.40 ± 8.77) differed significantly from those taught in Group Investigation Learning model (79.80 ± 7.01) ($P = 0.00$), and were not significantly different from those taught by Conventional model (68.76 ± 66.21) ($P = 0.12$). The follow-up of the results of this study was expected to teachers to be able to apply Inquiry learning model and Group Investigation learning model to Ecosystem topic in an effort to improve Cognitive Skill and Critical Thinking Skill of students at the schools.

Keywords: Inquiry; Group Investigation; Conventional; Cognitive Skill; Critical Thinking Skill; Ecosystem.

I. INTRODUCTION

Education aimed to develop the potential of students to become qualified human resources. Quality human resources in question are human beings who believe and devote to God, have noble character, are healthy, knowledgeable, capable, creative, independent, and competitive and become democratic and responsible citizens. In reviewing the improvement of education quality there is one approach that must be passed. Improving the quality of education is very closely related to the quality of teachers who organize education in schools, teachers are expected to be able to create an atmosphere or situation that allows students to learn well. To realize a learning atmosphere or to realize students more active in learning, it is necessary to apply learning strategies that can provide students with direct experience in the learning process (Afcariano, 2008). In the learning process, the teacher will provide knowledge to students and vice versa students will receive knowledge from the teacher, therefore in teaching activities the teacher must have a learning strategy so students can learn effectively and efficiently, so that the expected goals are achieved.

A student can achieve the results of adequate cognitive abilities in the teaching and learning process, if the teacher as an educator is able to utilize the method and selection of the right media in teaching. To be able to involve active students and think critically independently in the teaching and learning process in the classroom, and be able to improve student retention, an appropriate learning approach is needed by using the learning model. The use of the right learning model in teaching will greatly help the effectiveness of the learning process and the delivery of messages and content of the lesson. In addition to arousing student motivation and interest, the right learning model also helps students to improve understanding and information.

The results of interviews with biology teachers at Bhayangkari 1 Medan High School about Ecosystem material said student learning outcomes were very low, learning interest and learning motivation were very low, students preferred to receive information from teachers without trying to find out what was learned and when given problems very few students who responds, expresses opinions and tries to draw conclusions in classroom learning activities. When the teacher throws a problem at students, students can only answer shortly without linking the problem to their daily lives, and also critical thinking is not accustomed to solving problems well, KKM Biology science subjects are 70 and the values obtained from cognitive abilities most students don't get the minimum score which is 60 to 65.

In group learning only a few students are involved and active in learning, which is carried out in observations and discussions on ecosystem material usually observing components and interactions in ecosystem components, energy flow, maintaining balance and preserving ecosystem environments such as abiotic effects with biotics so that some large students are less able to connect between what is learned and how to apply it to real situations. This also affects the cognitive abilities of students where students do not understand maintaining the balance and sustainability of the Ecosystem environment.

Education is not only emphasized in mastering the material, but also emphasized the mastery of skills. Students must also have the ability to do something by using scientific processes and principles that have been mastered in teaching and learning activities. Students easily understand complex and abstract concepts if accompanied by concrete examples are one of the reasons underlying the need to apply critical thinking skills.

One way to improve the results of cognitive abilities, and critical thinking skills is to use the right learning model. The most popular and widely used learning model is Inquiry learning and Group Investigation models, because inquiry learning and Group Investigation are student-centered learning models with shared tasks (Arend, 2008).

II. MATERIALS AND METHODS

A. Research Design

This research was a quasi-experimental test. The study design was an experimental design with the design of the pretest-posttest group.

B. Samples

The population in this study were all students of grade X SMA Bhayangkari 1 Medan. The sampling technique was cluster random sampling. The sample chosen was X.1 class given treatment with inquiry learning, X.2 class was given treatment with group investigation learning, and X.3 class as a control class / conventional learning.

C. Instruments

The independent variables used were the inquiry learning model and the investigation group learning model that were applied to the experimental class and the direct learning model with the question and answer method also discussion applied to the control class. The dependent variable in this study were the cognitive ability and critical thinking ability. Data collection techniques used the test method in the form of multiple choice questions to measure cognitive knowledge and critical thinking skills.

Analysis of the research data using the ANACOVA test and Tukey's follow-up test with prerequisite tests using the Normality test with the Kolmogorov-Smirnov test and the Homogeneity test with the Leven's test.

III. RESULTS AND DISCUSSION

A. Results

The research data were in the form of an average value of cognitive abilities and critical thinking skills to determine the effect of the application of inquiry learning, group investigation and direct learning. The results of data processing showed that the average value of the test results and the standard deviation of cognitive abilities and critical thinking skills of students in the experimental group (inquiry and group investigation) was higher than the control group (conventional). Comparison of the average score of the test results and the standard deviation of cognitive abilities in the inquiry class was 73.75, in the group investigation class that was 77.21 while in the direct learning class was 67.71. Comparison of the average score of the results of the critical thinking ability test in the inquiry class was 72.40, in the group investigation class that was 79.80 while in the direct learning class was 68.76.

Based on the average score, it can be concluded that the group that has the highest score was the group investigation learning model class. Thus, the use of group investigation learning model gave a better influence on students' cognitive abilities and critical thinking abilities.

Furthermore, a prerequisite analysis of research data was carried out. Prerequisite analysis of research data was carried out by calculating hypothesis testing using the ANACOVA test technique. Hypothesis testing using the ANACOVA test was carried out after calculating the hypothesis prerequisite test, namely through the normality test and homogeneity test. Normality test was done to find out whether the data distribution comes from the normal population or not. The recapitulation of the results of the normality tests of cognitive abilities and students' critical thinking skills can be seen in tables 1 and 2.

TABLE 1. RECAPITULATION OF THE NORMALITY TEST OF COGNITIVE SKILLS

No	Learning Models	*Kolmogorov - Smirnov*	
		Sig.	Notes
1	*Inquiry*	0.06	Normal
2	*Group investigation*	0.38	Normal
3	Conventional	0.06	Normal

TABLE II. RECAPITULATION OF THE NORMALITY TEST OF CRITICAL THINKING SKILLS

No	Learning Models	*Kolmogorov - Smirnov*	
		Sig.	Notes
1	*Inquiry*	0.37	Normal
2	*Group investigation*	0.63	Normal
3	Conventional	0.45	Normal

Based on the calculation of the normality test above, it can be concluded that the distribution of data in the inquiry class, group investigation class and direct learning class on cognitive skills and critical thinking skills originated from populations that were normally distributed.

The variance homogeneity test was conducted to analyze whether the data from the sample population had homogeneous variances or not. Homogeneity test was carried out using the Leven's test. Recapitulation of homogeneity tests can be seen in tables 3 and 4.

TABLE III. RECAPITULATION OF HOMOGENEITY TEST FOR COGNITIVE SKILLS

Leven's Statistic	
Sig.	Notes
0.06	Homogeny

TABLE IV. RECAPITULATION OF HOMOGENEITY TEST FOR CRITICAL THINKING SKILLS

Leven's Statistic	
Sig.	Notes
0.15	Homogeny

Based on the homogeneity test, the score distribution of cognitive skills and critical thinking skills of the inquiry class, investigation group class and control class can be concluded that the data comes from a homogeneous population.

Hypothesis test was done after the data obtained was declared normal and homogeneous. Hypothesis test was done to find out whether the null hypothesis (Ho) submitted was accepted or rejected. Hypothesis test was done using the ANACOVA test statistical technique. Recapitulation of the results of hypothesis test of cognitive skills and critical thinking skills in inquiry class, investigation group and control class can be seen in table 5.

TABLE V. RECAPITULATION OF ANACOVA TEST TO COGNITIVE SKILLS

Score Recapitulation	F	Sig.	Notes
Cognitive Skills	5.14	.01	Ho was rejected

The results of the calculation of hypothesis test by using ANACOVA test showed that there was a significant effect on the inquiry class, investigation group class and control class on cognitive skills with Sig. <0.05 which was F = 5.14; P = 0.01. To see the treatment pair compared, whether all treatments gave different or the same effect, then Tukey's test was continued. The recapitulation of the results of the Tukey's further tests of cognitive abilities can be seen in table 6.

TABLE VI. RECAPITULATION OF ADVANCED TEST TO COGNITIVE SKILLS

Model	Tukey's		
		Sig.	Notes
Inquiry	GI	.470	Not significantly different
	Conventional	.102	Not significantly different
GI	Inquiry	.470	Not significantly different
	Conventional	.004	Significantly different
Conventional	Inquiry	.102	Not significantly different
	GI	.004	Significantly different

Based on the calculation of advanced tests of cognitive skills, the results showed that the cognitive skills who were taught by the inquiry model were not significantly different from the investigation group model and conventional model. The cognitive skills of students who were taught with group investigation learning model differed significantly from conventional learning model.

TABLE VII. RECAPITULATION OF ANACOVA TEST FOR CRITICAL THINKING SKILLS

Score Recapitulation	F	Sig.	Notes
Critical Thinking Skills	63.49	.000	Ho was rejected

The results of the calculation of hypothesis test by using the ANACOVA test technique showed that there was a significant effect on inquiry class, investigation group class and control class on critical thinking skills with Sig. <0.05 which is F = 63.49; P = 0,000. To see the treatment pair compared, whether all treatments gave different or the same effect, then Tukey's test was continued. The recapitulation of the results of the Tukey's further tests of students' critical thinking skills can be seen in table 8.

TABLE VIII. RECAPITULATION OF FURTHER TEST RESULTS FOR CRITICAL THINKING SKILLS

Model		Tukey's	
		Sig.	Notes
Inquiry	GI	.000	Significantly different
	Conventional	.121	Not significantly different
GI	Inquiry	.000	Significantly different
	Conventional	.000	Significantly different
Conventional	Inquiry	.121	Not significantly different
	GI	.000	Significantly different

Based on the calculation of advanced tests of critical thinking skills the results showed that the critical thinking skills of students who were taught by the inquiry model differed significantly from the group investigation learning model but did not differ significantly from conventional model. Critical thinking skill of students who were taught by group investigation learning models differ significantly from conventional learning model.

B. Discussion

*1) The Influence of Learning Models on Student's Cognitive Skills:*Based on data analysis that was carried out by using the ANACOVA test, the results of significant values were obtained (P = 0.01 <0.05). Thus, H_0 was rejected and Ha was accepted so that it was stated that there was a significant influence between the using of Inquiry learning, Group Investigation Learning and Conventional Learning models on cognitive skills of Biology subject in the Ecosystem material in grade X SMA Bhayangkari 1 Medan. The results of this study proved that the Inquiry learning model was very necessary to be applied, because the Ecosystem subject matter that was taught by the learning model was very appropriate to achieve learning objectives to the maximum score with the investigation of learning outside the classroom so that students' cognitive skills can improved well and developed. In line with the results of the study by Seniwati (2015) which states that there was an increase in students' biology learning activities and outcomes through the application of inquiry learning models. Inquiry learning model can increase students' motivation with different learning styles towards science learning, so Inquiry learning was recommended to improve students' learning achievement. With the use of learning using the investigation of the material discussed, the students were enthusiastic in learning so that they can improve students' cognitive abilities well.

Cognitive abilities were student learning outcomes that can be improved by the presence of learning models, so that with the presence of several learning models whose characteristics are different will have different effects on students' cognitive abilities. Thus in the Inquiry, Group Investigation and Conventional Learning models, the three of them have differences in the learning syntax. According to Sanjaya (2011) that in general the learning process by using inquiry learning models followed steps such as orientation, formulating problems, submitting hypotheses, collecting data, testing hypotheses and formulating conclusions.

According to Slameto (in Aggraini, 2013) that interest in learning has a large influence on learning achievement, because if the material learned is not in accordance with student interests, then students will be reluctant to learn and not get satisfaction from the lesson. Therefore, interest is very important as one of the impulses in self to improve learning abilities. One of the ways to improve students' enthusiasm is to have a variety of learning models used in class and outside the classroom. One of the learning models used is Group Investigation. This is in line with the research by Nengseh et al. (2015) that the Group Investigation learning model influences students' cognitive, affective, and psychomotor learning outcomes.

IV. CONCLUSION

Based on the results of the research and discussion, it was concluded that there was a significant influence of Inquiry and Group investigation learning models on cognitive skills and critical thinking skills in Ecosystem material for grade X SMA Bhayangkari 1 Medan.

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REFERENCES

[1] Afcarino, M. 2008. Penerapan Pembelajaran Berbasis Masalah Untuk Meningkatkan Kemampuan Berpikir Siswa Pada Mata Pelajaran Biologi. *Jurnal Pendidikan Inovatif, 3 (2): 68-69.*

[2] Anggraini, E. 2013. Hubungan Antara Minat Belajar dan Fasilitas Belajar Siswa dengan Prestasi Belajar Sosiologi. *Skripsi (tidak dipublikasikan).* Surakarta: Universitas Sebelas Maret.

[3] Arends, R.I 2008. Learning to Teach: Belajar untuk Mengajar. Buku Dua. (penerjemah: Helly Prayitno Soetjipto dan Sri Mulyantini Soetjipto). Pustaka Pelajar. Yogyakarta.

[4] Aslahah, H., Susilo, H., Prasetyo, T.I. 2015. Pengaruh Strategi Pembelajaran *Group Investigation* (GI) terhadap Kemampuan Berpikir Kritis Siswa SMA di Kota Malang. *Jurnal Pendidikan Malang,* 1(2): 1-9.

[5] Boaventura dan C. Faria, 2015. Science Inquiry-Based Acti*vities* in Elementary Education: How to Support Teachers" Practices. *International Journal of Information and Education Technology.* 5(6): 451 - 456

[6] Budimansyah. 2007. *Pembelajaran Group Investigation.*(online). Diakses pada Desember 2014

[7] Bangun. 2012. *Pengaruh Strategi Pembelajaran Terhadap Aktivitas Siswa Hasil Belajar Biologi dan Kemampuan Berpikir Kritis Siswa di SMP Negeri 2 Medan,* Medan: program Pascasarjana Unimed.

[8] Dahar, R., W. 2011. *Teori-teori Belajar dan Pembelajaran.* Jakarta: Erlangga.

[9] Daryanto. 2009. *Panduan Proses Pembelajaran Kreatif dan Inovatif.*Jakarta: Penerbit Publisher.

[10] Eggen. P. D., & Kuachak. D. P. (1998). *Strategiesfor Teacher. Teaching Contens and Thinking Skill.* Boston: Allyn and Bacon

[11] Ginting, D, I., Djulia, E, dan Gultom, T. 2017. Pengaruh Pembelajaran Problem Base Learning (PBL) dan Group Investigation (GI) Terhadap Keterampilan Proses Sains di MAN Kabanjahe. *Journal Pendidikan Biologi.*Vol (6)

[12] Hamruni. 2012. *Strategi Pembelajaran.* Yogyakarta: Insan Madani.

[13] Iskandar. 2009. *Psikologi Pendidikan: Sebuah Orientasi Baru.* Jakarta: Gaung Persada Press.

[14] Kemdikbud. 2014. *Buku Guru Ilmu Pengetahuan Alam SMP/MTs Kelas VII* (Edisi Revisi). Jakarta: Kemdikbud.

[15] Ketpichainarong, W., B. Panijpan., P. Ruenwongsa. 2010. Enchanced learning of biotechnology students by an inquiry-based cellulose laboratory. International Journal of Environmental & Science. 5(2): 169 – 187.

[16] Marpaung, D. 2017. Pengaruh Model Pembelajaran Inquiri dan Group Investigation Terhadap Hasil Belajar Biologi dan Keterampialan Proses Sains Siswa Pada Materi Sistem Pencernaan Kelas XI SMA Negeri 1 Siantar: *Tesis.* Medan: Program Pascasarjana Universitas Negeri Medan.

[17] Nengseh, E.B., Masjhudi, dan Prasetyo, T.I. 2015. Pengaruh Pembelajaran Kooperatif Model Group Investigation (GI) terhadap Hasil

Belajar Siswa SMA Negeri 1 Purwosari pada Materi Animalia. *Jurnal Pendidikan Malang,* 1(2): 1-13.

[18] Nugroho, S., Suparmi, Surwanto. 2012. Pembelajaran IPA dengan Metode Inkuiri Terbimbing Menggunakan Laboratorium Riil dan Virtuil Ditinjau dari Kemampuan Memori dan Gaya Belajar Siswa. *Jurnal Inkuiri Pasca UNS,* 3(1): 235 – 244.

[19] Okada, A. 2013. Scientific literacy in the digital age: tools, Environments and Sources for co-inqury. *European Scientific Journal,* 4: 263 – 274.

[20] Opara, J. 2011. Inquiry Method and Student Academic Achievement in Biology Lessons and Policy Inplications. *American-Eurasian Journal of Scientific Research.* 6 (1): 28 – 31.

[21] Purwanto, 2011. *Evaluasi Hasil Belajar.* Surakarta: Pustaka Pelajar.

[22] Quitadamo, I. J., C. L. Faiola, Johnson, and M, J, Kurtz. 2008. Communitybased Inquiry Improves Critical Thingking in General Education Biology. *Jurnal Life sciences Education.* 7(1):327-337.

[23] Rahayu. S. 2004. Implikasi Pembelajaran Kooperatif dalam Mata Pelajaran IPA berdasarkan Kurikulum 2004. *Makalah disajikan dalam seminar dan workshop Calon Fasilitator Kolaborasi dengan UM-MGMP MIPA Kota Malang.* 19-20 Maret 2004.

[24] Rustaman. 2007. *Strategi Belajar Mengajar Biologi,* Malang: Universitas Negeri Malang.

[25] Rustaman. 2009. *Keterampilan Proses Sains.* Bogor: Ghalia Indonesia.

[26] Rustaman, N. Y. (2005). Perkembangan Penelitian Pembelajaran Berbasis Inkuiri Dalam Pendidikan Sains. *Seminar Nasional II Himpunan Ikatan Serjana.*