The effect of using scientific ecosystem material of experimental method towards students’ scientific attitude

Nurlaili¹, Yusrizal¹ and A Amsal²
¹Department of Science Education, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia
²Department of Physics Education, Universitas Syiah Kuala, Banda Aceh, 23111, Indonesia
³Universitas Islam Negeri Ar-Raniry, Banda Aceh, 23111, Indonesia

E-mail: yusrizal_fkip@unsyiah.ac.id

Abstract. Students’ scientific attitude is one of the factors which affect students’ achievement. By using the pretest-posttest method, the purpose of this research was to know the significant effect of using experimental methods towards students’ scientific attitude. This research was conducted on April 9th – May 7th, 2019 at Junior High School 1 Baitussalam. The sample of this research was 28 students that were taken by using purposive sampling technique. In collecting the data, this research used questionnaires which analyzed by using SPSS 20 version and Microsoft excel. The instrument of this research was 36 items of questionnaires. The result of this research found that there was a positive significance effect by using experimental methods towards students’ scientific attitude which described (result = 7.08 > table = 2.03)

1. Introduction
Science subject is one of the learning subjects which increases students’ knowledge, skills, creativity, and students’ attitude in case of developing critical thinking, deductive or inductive ways to solve the problem about the environment[1]. It shows that Science subject is not only about increasing the students’ knowledge but also developing students’ attitude and their skills through directly watching, doing, experiencing themselves in learning itself. Based on the interviews to teachers at Junior High School 1 Baitussalam, the researcher founds several problems which happened in teaching and learning process of ecosystem material, those are the teachers that teach ecosystem material in the classroom still use conventional method which means using memorization and repetition of keywords that taught by teachers. It perhaps helps students in experiencing the learning itself directly in case that the science subject was learned by students in the long term of time.

The achievement of students does not only reflect on their score but also their attitude in solving the problem in learning [2]. As mentioned in the problem, it needs the methods of teaching and learning which involve the students themselves in the learning process. Hence, the experimental method is one of the methods that involve the students themselves in the teaching and learning process [3]. Experimental methods also mean students solve the problem by experiencing it to establish their knowledge, skills, and also attitude [4]. Scientific approach that used due to increasing their score in learning, in this research the score of students was good enough. The scientific approach in the experimental method in the teaching and learning process was good for increasing students’ scores,
skills, and attitudes. Observation shows that there are many students solve the problem through measurement. Laboratory works, is effective in solving the problem to increase students' attitude[5].

2. Method
The design of this research was a pretest-posttest design. The sample was taken by using a purposive sampling technique that examining the basic knowledge of the ecosystem. The next VII-1 class was chosen as an experimental class and VII-2 was the control class each was 28 students. Experimental class was given experimental method and control class was as usually known as lecture method. Attitude scale used due to collecting the data[6]. There were 36 items in questionnaires that used in this research (Those are 18 positive items and 18 of negative items) with the answer Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). Through these questions will know whether there is a significant effect of using an experimental method or not. The measurement of this research scale was mentioned in Table 1. The ideal score of 36 items of questionnaire was 36 x 4 = 144, the lower score was 36 x 1 = 36.

Table 1 Items of questionnaire of students scientific attitude

| No | Answers                       | Positive statement | Negative statement |
|----|-------------------------------|--------------------|--------------------|
| 1  | Strongly Agree (SA)           | 1                  | 4                  |
| 2  | Agree (A)                     | 2                  | 3                  |
| 3  | Disagree (D)                  | 3                  | 2                  |
| 4  | Strongly Disagree (SD)        | 4                  | 1                  |

(Source: Sukardi, 2011)[7]

The researcher used this scale as a guidance in analyzing the data of questionnaires. Data analyzing of attitude scientific index by using:

\[
\text{Score} = \frac{\text{Real Score}}{\text{Total Score}} \times 100
\]  

Average score was gotten, then categorized as the follows criteria:

| Score scientific attitude | Criteria      |
|---------------------------|---------------|
| 81.00 – 100               | Very good     |
| 61.00 – 80.99             | Good          |
| 41.00 – 60.99             | Fair          |
| 21.00 – 40.99             | Poor          |
| 0 – 20.99                 | Very poor     |

3. Result and Discussion
Students' scientific attitude on ecosystem material measured by using questionnaires filled by the students. The questionnaire was given to the students who attend experiment class which taught by using experiment and control class taught by using explanation, questioning, and answering. The questionnaire was given after taught by using an experiment and the number of questions in the questionnaire was 36 with four options. The statements about scientific attitudes were formed from research [8]. However, the question items were formed by the researcher. The result of the scientific attitude questionnaire showed that all of the indicators about scientific attitude in the class are categorized as good and scientific attitudes in the control class are categorized into fair. Students in high grade showed better scientific attitude for ecosystem material rather than lower grade [9]. It resulted from calculation.
### Table 3. Recapitulation of scientific attitudes based on indicator

| No | Scientific attitude indicators                      | Experiment class | Control class |
|----|-----------------------------------------------------|------------------|---------------|
| 1  | Inquiring                                           | 74               | 70            |
| 2  | Respect toward facts                                | 71               | 67            |
| 3  | Critical thinking                                   | 73               | 74            |
| 4  | Discovery and creativity                            | 70               | 68            |
| 5  | Open minded and cooperation                         | 73               | 67            |
| 6  | Diligence                                           | 73               | 66            |
| 7  | Care with environment                               | 75               | 67            |

The data above informed inquiring as scientific attitude categorized into good with 74% in experiment class. The students showed their inquiry through discussion with other classmates and questioning and it was an indication of the inquiry toward learning material during the learning process. Inquiry emerged because the problem proposed by the teacher was related to students’ daily activities, as a result, students curious to do exploration about learning material [10]. The scientific attitude indicator in the control class was categorized into good (70%). It was noticed from students’ attitudes which responsive during the learning process.

Respect toward fact indicator in experiment categorized into good (71%). It showed that the students were able to collect the information based on the fact that they got. Meanwhile, respect toward fact in control class was categorized into fair (67%) It happened because the control class was teacher-centered and there was not scientific experiment so, the scientific attitude was not maximal.

The scientific attitude in the experiment class was better because students were active during the learning process. The critical thinking indicator in the experiment class was categorized into very good (73%). During the learning process, students pay attention to the teacher and ask some questions if they did not understand. Then, they asked some question about ecosystem which understand yet. The indicator in the control class categorized into good (72%). It was caused by the learning process which used the teacher center, the students only accepted information, and there was no scientific experiment as a result, students were unable to understand the lesson about the ecosystem with clear. The lesson with scientific experiment was able to increase students’ critical thinking. Similarly, one of opinion [11] said to get knowledge not only by using reading but also through observation which did through systematic process until the scientific attitude emerged.

The indicator of discovery and creativity was categorized into good (70%). In the experiment, class students were enthusiastic to find the answers given by each group and it was showed students’ discovery and creativity. The indicator of discovery and creativity in the control class was categorized into fair (68%). It was an effect from the explanation that gave by the teacher without involving active participation from students during the learning process as a result, students have less creativity.

In experimental class open-minded and cooperation indicator was categorized into fair (73%). It was seen that students did cooperate during the learning process with the other students to find the correct answer. In control class, open-minded and cooperation indicator was categorized into good (67%). It was caused students to listen to the teacher and their classmate’s instructions to follow the class with enthusiasm as a result, the cooperation did not happen. In experimental class, diligence indicator was categorized into good (73%). The students were willing to redo their scientific experiment because they doubt the result that they found and the students also helped their classmates to complete the task. In the control class, the diligence indicator was categorized into fair (66%). It happened because the students were less attention and in control class, the students did not have a scientific experiment so, they only pay attention to their teacher instruction.

The care to environment indicator was categorized into very good (75%). In the experimental class, students were cared about their environment, keep cleanliness and it was an indication of caring for
the environment. The scientific approach was able to increase students’ awareness to decide environmental problems [12]. In control class caring for the environment, the indicator was categorized into good (67%). In this case, the teacher was able to ask the student to keep the cleanliness of the school and invite them to participate in the phenomena around them. Caring for the environment increased because the students asked to keep the cleanliness of the school and environment after a scientific experiment did. Then, the students were asked to participate in a school activity [13]. There are significant differences in supporting students’ achievement in experiment class toward caring for the environment [14]. The learning environment positively influenced the scientific attitude and the way to teach science [15]. Experiment method can help the students to learn scientific, structured, and independent

| Table 4. Students’ scientific attitude score at experiment class and control class. |
|-----------------------------------|----------------|----------------|
| Calculation                       | Experiment class | Control class   |
| Scientific attitude average       | 73             | 69             |
| Standard deviation                | 4.18           | 3.79           |
| Varians                           | 18.15          | 14.91          |
| \(t_{count}\)                     | 7.08           |                |
| \(t_{table}\)                     | 2.03           |                |

The analysis toward table 4 showed that the value of \(t_{count}\) (7.08), meanwhile the value of \(t_{table}\) is 2.013. Based on the data above, it can conclude that \(t_{count}\) (7.08) > \(t_{table}\) (2.013). It showed there is a significant difference between the experiment class which used the experiment method with a scientific approach and control class which uses the explanation method. The experiment method was able to make students success to get a better mark in a science subject [16]. Therefore, the hypothesis which stated that students’ scientific attitude with using the experimental method was better than explanation, questioning and answering method in ecosystem material at SMPN 1 Baitussalam.

Learning with using the experimental method was able to make students develop their scientific attitude and it also affects the increase of students’ scientific attitude. To gain knowledge, reading is not the only way [17]. The experiment method was suitable to increase students’ scientific attitude. Using the Experiment method, the observation about the way students’ learn is easy to do. Students’ scientific attitudes were increased during the learning process. Students’ attitudes always dynamic and it can change because of the condition and environment situation [18]. There is a significant difference in terms of problem-solving and students’ scientific attitude in participating in the learning process which used the method that develops based on equipment used by the teacher [19]. There is a difference between experiment class and control class in terms of independent learning and scientific attitude toward ecosystem material [20].

4. Conclusions
Learning outcomes of students at two secondary schools were in medium level with both care with environment is 75 with a good category. Thus, student worksheets effectively can be used as an alternative teaching material on ecosystem material practice.

References
[1] Sukarmin S, Suparmin S and Katimo K 2016 Pengaruh Pembelajaran dengan Pendekatan Saintifik Menggunakan Metode Eksperimen dan Demonstrasi Terhadap Prestasi Belajar dan Kreativitas Ditinjau Dari Sikap Ilmiah J. Inkuiri 87
[2] Soraya R and Syofyan H 2017 Penerapan Metode Eksperimen untuk Meningkatkan Sikap Ilmiah Siswa Dalam Pembelajaran Ipa di Kelas V Sdn Kelapa Dua 06 Pagi Jakarta J. Eduscience 3 16
[3] Okono E O, Sat L P and Awuor F M 2015 Experimental approach as methodology in teaching physics in schools *International J. Of Academic Research In Business and Social Sciences* 5 1

[4] Jaya W G, Patasik B, Sembel E K, Subagioyo L and Yunus M 2014 Penerapan Pendekatan Saintifik Melalui metode eksperimen pada pembelajaran fisika siswa kelas x miia 3 SMA Negeri 1 Tenggarong materi suhu dan kalor *Saintifikasi* 16(22)

[5] Hadiati S, Kusmawanto H, Rosana D and Pramuda A 2019 The Effect Of Laboratory Work Style and Reasoning With Arduino to Impprove Scientific Attitude *International J. of Instruction* 12(2) 321

[6] Ince H, Cenberci S and Yavuz A 2018 The Relationship Between The Attitudes of Mathematics Teacher Candidates Towards Scientific Research and Their Thinking Styles *Universal J. of Educational Research* 6(7) 1467

[7] Sukardi 2011 *Metodologi Penelitian Pendidikan* (Jakarta: Bumi Aksara)

[8] Anwar H 2009 Penilaian Sikap Ilmiah dalam Pembelajaran Sains J. Pelangi 2 1

[9] Erdogan S C 2015 Investigating Pre-Service Gifted Education Teacher Self-Efficacy Toward Science Teaching and Scientific Attitudes *Eurasian J. of Education Research* 15(59) 133

[10] Wulandari A, and Rohaeti, E 2017 Pengaruh Penerapan Metode Eksperimen Berbasis [Problem Based Learning] Terhadap Sikap Ilmiah dan Prestasi Belajar Kimia [The Effect Of Implementation Experiment Method Based On Problem Based] J. Pembelajaran 6 1

[11] Amin M 1994 *Mengajarkan Ilmu Pengetahuan Alam dengan Metode Discovery and Inquiry* (Jakarta: Departemen Pendidikan dan Kebudayaan)

[12] Ercan O, Ural E and Kose S 2017 The Effect of Web Assisted Learning wiyh Emotional Intelligence Content On Emotional Inteligence *Science Education International* 28(1) 94

[13] Sari K, Syukri M and Halim A 2015 Pengaruh Penerapan Metode Eksperimen Dan Inkuiri Terbimbing Terhadap Keterampilan Proses Sainsdan Sikap Ilmiah Siswa J. Pendidikan Sains Indonesia 3 51

[14] Zobi A S 2015 The Effect of Using Socio-Scientific Issues Approach in Teaching Enviromentl Issues on Improving the Students Ability of Making Appropriate Decisions Towards These Issues *International Eduction Studies* 7(8) 113

[15] Erdogan S C S 2017 Science Teaching Attitudes and Scientific Attitudes of Pre-Service Teachers of Gifted Students *J. of Education and Practice* 8(6) 164

[16] Masnah 2016 Peningkatan Hasil Belajar Ipa Materi Tumbuhan Hijau Melalui Metode Eksperimen Kelas V SDN Babbadan Semester 1 Tahun Pelajaran 2015/2016 J. Refleksi Edukatika 7 30

[17] Sudrajat 2018 Penggunaan Metode Eksperimen Untuk Meningkatkan Pemahaman Konsep Dan Keterampilan Proses Siswa Tentang Pengaruh Kegiatan Manusia Terhadap Keseimbangan Lingkungan Dalam Pelajaran IPA Di Kelas Iv SD Negeri Lambanagara Raya Kecamatan Ciamis Kabupaten Ciamis J. PETIK 4 44

[18] Dayaskini T and Hudaniyah 2009 *Psikologi sosial* (Malang: UMM Pres)

[19] Saputri A A and Wilujeng I 2017 Developing Physics E-Scaffolding Teaching Media to Increase the Eleventh-Grade Students' Problem Solving Ability and Scientific Attitude *International J. of Environmental and Science Education* 12(4) 729

[20] Ceylaner S G and Karakus F 2018 Effects of the Flipped Classroom Model on Students' Self-Directed Learning Readiness and Attitudes towards the English. *Course 11 English Language Teaching* 11(9) 129