Enhancing students’ cognitive skill in Nguyen Tat Thanh high school Hanoi Vietnam through scientific learning material of static electricity

A Priyanto1,*, S Linuwih1, M P Aji1 and D D Bich2
1Department of Physics, Universitas Negeri Semarang, Indonesia
2Deputy head, Division of Solid state and electronic physics
Vice principal, Nguyen Tat Thanh Lower and Upper Secondary School
Hanoi National University of Education, Vietnam

*Corresponding author : priyantoaan22@gmail.com

Abstract. Scientific learning material is still needed by students at Nguyen Tat Thanh High School (NTT), Hanoi Vietnam in order to enhance the students’ cognitive skill. Cognitive skill represents the level of students’ understanding to the particular material. Students’ cognitive skill can be improved by applying the learning material based on scientific approach as a treatment. The enhancement of students’ cognitive skill can be measured by analyzing the students’ test result collected before and after treatment. The analysis is focused to measure the enhancement or the sifted of cognitive aspects including remembering aspect (C1), understanding aspect (C2), applying aspect (C3), analyzing aspect (C4), and evaluating aspect (C5). According to the analysis the enhancement of cognitive aspects are 8.26% of remembering, 3.26% of understanding, 32.94% of applying, 21.74% of analyzing, and 21.74% of evaluating. The major enhancements are occured at applying, analyzing, and evaluating aspects. Therefore it can be concluded that students’ cognitive skill is enhanced by applying scientific learning material of static electricity.

1. Introduction
Nguyen Tat Thanh School (NTT), established on July 4th 1998, located in Cau Giay district, Hanoi, which is about 6 km from the Old Quarters, Vietnam. This school stated under the Hanoi National University of Education. Scientific learning material is still required by students at NTT in order to enhance the cognitive skill of the students. Researcher reported that that the early years of childhood are particularly important in setting of the cognitive skill [1,2]. In this case, it can be concluded that the job specific-skill--such as social skill--can be formed later. Cognitive skill represents the level of students’ understanding to the particular material [3].

According to the revised Bloom’s Taxonomy, the aspect of cognitive processes include the ability of remembering, understanding, applying, analyzing, evaluating, and also creating [4]. There are many numbers of efforts in order to enhance the cognitive skill such as using development of learning material and simple experiment using natural resources [5-7]. In this research we were adjusting scientific approach into learning material to improve the students’ cognitive skill.

Most of the students consider that static electricity is an abstract lesson and difficult to understand conceptually. Correspondingly, the material of static electricity in high school level is an abstract
physics and it requires specialized learning [8]. Another argues that the electrostatic material and the electric field is a matter of abstract, thus making it’s difficult for students to understand. The appropriate solution in making static electricity material to be easy to understand is by compiling suitable learning materials for the students. In addition scientific learning material plays an important role in order to enhance students’ cognitive skill.

2. Methods
The method which is used in this research is called research and development. After the learning material was constructed then it can be tested to a sample experiment class. The experiment class is consisted 46 students grade 11N1 in NTT. This experiment research used pre-test—post-test control group design as shown in Table 1 [9].

| Table 1. Pre-test—Post-test Control Group Design |
|-----------------------------------------------|
| Sample           | Initial Condition | Treatment | Final Condition |
| Experiment Class | O₁                | X         | O₂              |
| Control Class    | O₃                |           | O₄              |

Pretest and posttest questions are already classified into remembering-questions (C1), understanding-questions (C2), applying-question (C3), analyzing-questions (C4), and evaluating-questions (C5). Then from the pretest and posttest result of experiment class can be determined the enhancement of students’ cognitive skill.

3. Result and Discussion
Development of static electricity learning material is designed in order to improve the cognitive abilities of the student through the scientific method. This learning materials are composed of static electricity that reviews the material consists of three main sub-materials including properties of electric charges, coulombs’ Law, and the electric field. Those three sections are selected in accordance with the curriculum at Nguyen Tat Thanh High School Hanoi Vietnam. Systematically and structurally static electricity learning materials consists of the initial cover page, preface, the aimed competences, a list of content, introductory material, natural phenomena related to the material, simple experiment, review the material, sample questions and answers, exercises, and evaluation questions.

The novelty of this learning material is shown by applying scientific learning processes. Static electricity learning materials based on scientific approach is eligible to be used in learning process. Cognitive analysis is conducted by analyzing the average percentage of students' cognitive skill according to the revised Bloom's Taxonomy by Kratwohl in 2002. The aspects of cognitive skill including of aspect C1: remembering, C2: understanding, C3: applying, C4: analyzing, C5: evaluating and C6: creating. This study analyzed the first five cognitive skills (C1-C5).

The average percentage of students’ cognitive skill can be determined through a number of students who correctly answered questions of pre-test and post-test. Questions of pre-test and post-test have been structured to interpret the assessment of the first five cognitive aspects (C1-C5). The result of students’ cognitive skill before and after treatment as shown in Figure 1.
Figure 1 describes the enhancement students' cognitive skill of experiment class based on pre-test and post-test results. The aspect of remembering shows the students' ability to recall concepts they ever learned. According to the revised Bloom's Taxonomy that remembering is a process that consists of recognizing and recalling knowledge stored in long-term memory [10]. The percentage of students' cognitive skill regarding to C1 aspect before the treatment is 78.26%. Meanwhile, after learn the learning materials, the percentage of the student's cognitive skill regarding to C1 aspect is 86.52%. In this case the enhancement of remembering aspect is 8.26%.

The aspect of understanding (C2) rose 3.26%. According to the revised Bloom's Taxonomy, cognitive skill of understanding is the process of discovering the meaning of learning materials including oral, written, and graphical communication. This cognitive skill consists of the ability of interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. Therefore, the overall abilities of understanding skill in the experiment class rose after learning used scientific learning materials.

The aspect of applying (C3) is increased by 32.94%. According to the revised Bloom's Taxonomy, cognitive skill of applying is the process of implementing the use of a given procedure. This cognitive skill consists of the ability to executing and implementing. Thus both the ability of applying skill in the experiment class rose after receiving learning used scientific learning materials.

The aspect of analyzing (C4) is increased by 21.74%. According to the revised Bloom's Taxonomy, cognitive skill of analyzing is a process to parse knowledge of grouping and identifying relationships between components to find the structure in question. This cognitive skill consist capabilities of differentiating, organizing and attributing. From the Figure 1 it can be concluded that the students of experimental class can develop the ability to analyzing.

The aspect of evaluating (C5) is increased by 21.74%. According to the revised Bloom's Taxonomy, cognitive skill of evaluating is the process to judging criteria and standards. This cognitive skill consists of the ability of reviewing, checking and critiquing. Based on the analysis, it can be concluded that the evaluating skill of the experiment class rose after learning used scientific learning materials of static electricity.
The major enhancement occurred at applying, analyzing, and evaluating aspects that represent the higher cognitive skill as shown at Figure 2.

![Diagram showing cognitive skill enhancement percentages]

**Figure 2.** Chart enhancement percentage of student ability regarding to the cognitive skill.

Figure 2 shows that the experiment class has more dominant enhancement of cognitive abilities in the category of C3 (applying), C4 (analyzing) and C5 (evaluating). Therefore it can be concluded that with the implementation of static electricity learning materials based on scientific processes can significantly improve students' cognitive skill.

4. Conclusion
The enhancement of cognitive aspects are 8.26% of remembering, 3.26% of understanding, 32.94% of applying, 21.74% of analyzing, and 21.74% of evaluating. The major enhancement occurred at applying, analyzing, and evaluating aspects as higher cognitive skills. Therefore it can be concluded that scientific learning material of static electricity can improve the students’ cognitive skills into higher cognitive skills.

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