Profile of Cognitive Ability and Multiple Intelligence of Vocational Students in Application of Electric Energy Conservation

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Abstract. The purpose of this study is to obtain a profile picture of cognitive ability and multiple intelligence of students on physics learning activities in relation to the discourse of conservation of electrical energy. Research activities are conducted in the even semester of the 2015/2016 school year. The subjects of the study were the students of class XI (36 students) in one of the state vocational schools in Bandung consisting of one class chosen at random (cluster random sampling). Research data in the form of cognitive ability test results and multiple intelligences are analyzed descriptively and qualitatively. Research data is then analyzed and compared with predetermined success indicators. The results showed that the cognitive abilities profile of students in vocational schools in Bandung is still low. This can be seen from the average score of cognitive ability of students in remember (C1) of 57.75, understanding (C2) of 53.50, applying (C3) of 43.75, and analyzing (C4) of 37.75. The multiple intelligence profiles indicate frequency of linguistic intelligence number 9 students, musical intelligence 3 students, logical mathematical intelligence 13 students, spatial intelligence 7 students, kinesthetic intelligence 5 students, intrapersonal intelligence 7 students, interpersonal intelligence 6 students, and naturalistic intelligence 5 students.

1. Introduction
The limitation of electrical energy is one of the crucial issues that are currently emerging in various countries in the world. Even this crucial issue becomes one of the targets listed in 2030 sustainable development goals agreed by world leaders to be overcome [1]. In addition, this crucial issue is also a very serious concern for Indonesia, given the data from the ASEAN Center for Energy (ACE) states that Indonesia is a country with the highest level of waste of electrical energy today. Though the electricity supply in Indonesia itself is currently in critical condition and standby because the remaining reserves are not widely available. As reported in Badan Pengkajian dan Penerapan Teknologi (BPPT) by PT PLN (Persero), in the last five years the growth of power plant development, at 6.5% per year, cannot pursue the growth of electricity demand by 8.5% per year [2].

In some other countries, energy conservation which is one of the easiest ways to overcome the limitation of electrical energy than to build the supply of electrical energy resources has entered the
policy level such as the reduction of the use of electrical energy for industrial purposes. That is, only 20% of industrial activity uses electrical energy, while the rest already use natural energy (solar thermal energy, gas energy, wind, sea tides and others). As in Indonesia, although not yet up to the regulation of the percentage of electricity usage for industrial purposes, various efforts have been taken by the Government to reduce the number of large electricity usage, such as advice related to the use of electricity during the day, turn off the lights when not in use, even using energy. However, the culture of people who still like to turn on the lights during the day or use electricity for things that are not important still occur and need more effort to change. One of them through a systematic and integrated education at the school age level that can provide a positive impact to the wider community.

In one of the objectives of physics subject at vocational school level, it is mentioned that the implementation of physics subject at vocational school level is intended as a vehicle or means to train students to master the knowledge, concepts, and principles of physics [3]. In the process of learning physics is not only emphasize the mastery of the concept only (content) but also should contain the four things: the content or products, processes or methods, attitudes, and technology so that students' understanding of physics becomes intact and can be useful to solve the problems faced in daily life [4]. Content or product, means that in physics there are facts, laws, principles, and accepted theories. Process or method, means physics is a process or method to gain knowledge. Attitude, meaning physics can develop a scientific attitude such as diligent, thorough, open and honest. Technology, means physics related to the improvement of quality of life.

In addition, in the learning process it is necessary to be able to understand the ability of students personally, acknowledge their existence with all the ability they have, appreciate the talent and the results of his works. A number of researchers [5]; [6]; [7]; [8]; [9]; [10]; [11] and [12] provide assertion that, the success of students in the class depends on the proper use of the various multiple intelligences it has. Multiple intelligences include not only linguistic and mathematical logic, but also include kinesthetic, musical, visual-spatial, interpersonal, intrapersonal and naturalist aspects tailored to the characteristics of the concepts studied. These types of intellectual intelligence are known by multiple intelligences introduced and developed by Howard Gardner [13].

Judging from the goal, the physics subject is very good for students if it can be implemented as expected. Then it becomes an important thing also if the learning activities that occur in the classroom is implemented based on the consideration of multiple intelligences owned by each student and in accordance with the characteristics of material content delivered. In addition to course in physics lessons there is an electric concept that is very possible to be directed in the conservation of electrical energy.

Based on above description, the purpose of this study is to obtain a profile picture of cognitive ability and multiple intelligence of students on physics learning activities in relation to the discourse of conservation of electrical energy.

2. Experimental Method
The research method used is qualitative research that aims to explain the phenomenon of problems experienced by students in understanding and applying electrical concept. The data collecting technique used is observation of teacher and student activity, giving cognitive ability test and multiple intelligence test, interview with physics subject teacher, and ending with questionnaire of student response to lesson and learning done by physics subject teacher.
Table 1. Data collection technique

| No. | Necessary data                                      | Data source                              | Data Retrieval Techniques              |
|-----|-----------------------------------------------------|------------------------------------------|----------------------------------------|
| 1.  | Profile of teaching and learning activities conducted by teachers and students | Observation note                         | Observation                            |
|     |                                                     | Interview data                           | Interview                              |
|     |                                                     | Student response questionnaire data      | Post student response                   |
| 2.  | Profile of students' cognitive abilities            | Data test results cognitive ability      | Test cognitive abilities               |
| 3.  | Multiple intelligence profile                       | Data results of multiple intelligences tests | Test of multiple intelligences         |

The students' cognitive ability test used in this research is a matter that examines students' concept comprehension [14]. The test instrument consists of 33 items of multiple choice concerning the concept of direct current electricity. The test instrument used to test multiple students' intelligence uses standardized tests adapted from "The Rogers Indicator of Multiple Intelligences (RIMI) Test" for vocational school level. The test instrument consists of 56 item-shaped items likert scale 1-5 (Seldom-Always). Research data in the form of cognitive ability test results and multiple intelligences are analyzed descriptively and qualitatively. Research data is then analyzed and compared with predetermined success indicators. The success parameters used to see the achievement of cognitive ability is the acquisition of the completeness of the minimum subjectivity criteria is 75.

Research activities are conducted in the even semester of the 2015/2016 school year. The subjects of the study were the students of class XI in one of the State vocational schools in Bandung consisting of one class chosen at random (random sampling).

3. Result and Discussion

3.1. Student cognitive ability profile

The level of cognitive abilities include remember (C1), understand (C2), apply (C3), analyze (C4), Evaluate (C5), and create (C6) [14]. In this study, these cognitive abilities are limited to remember (C1), understanding (C2), applying (C3), and analyzing (C4). The following shows the average score for each cognitive domain in the class that is the subject of research. The profile of cognitive ability can be seen in Figure 1.
Figure 1 shows that students' cognitive abilities at every level of cognitive domain are low. This can be seen from the average value of the acquisition of students in the area remember (C1) of 57.75, understand (C2) of 53.50, apply (C3) of 43.75, and analyze (C4) of 37.75. This means that if the minimum subjectivity criteria, the cognitive ability profile of students are still under the minimum subjectivity criteria.

3.2. Multiple student intelligence profile

The multiple intelligences referred to in this study are problem-solving skills and creating culturally valuable products or a set of capabilities, skills or emerging intelligence that includes language (linguistic), logical Mathematical, kinesthetic, musical, visual-spatial, interpersonal, intrapersonal and naturalist.

Figure 2 shows that in one class there are various students with various dominant intelligences he has. From Figure 3 it can also be seen that mathematical logical intelligence and linguistic intelligence are more dominant with each frequency value consecutively are 13 students and 9 students. However, that does not mean in the process of learning physics can be neglected for other compound intelligence, such as musical intelligence 3 students, spatial intelligence 7 students, kinestetical intelligence 5 students, intrapersonal intelligence 7 students, interpersonal intelligence 6 students, and naturalistic intelligence 5 students.
4. Conclusion
Based on the research that has been done to obtain the conclusion that the profile of cognitive abilities of students in vocational schools in Bandung is still low. This can be seen from the average score of cognitive ability of students in remember (C1) of 57.75, understanding (C2) of 53.50, applying (C3) of 43.75, and analyzing (C4) of 37.75. One possible cause of low cognitive abilities of students due to the implementation of physics learning in schools is still using conventional learning. Therefore, the learning of physics is more informative that the teacher conveys the material to the students as a whole and less involving the students in the learning process. In addition, from the results of observation of learning and interviews with teachers subjects can be seen that in the learning process the teacher was not accommodate the multiple intelligences of students and feel not enough time in directing the concept of electricity on the issue of conservation of electrical energy.

In relation to the results of the research, it is necessary to improve or innovate the learning process so that the students are more involved in learning and feel the various challenges they have to find the solution from various problems they face in the environment. With the involvement of students in such learning process will make it easier for them to find and understand the concepts learned, accommodate their multiple intelligences, and equally important to make them more sensitive to the various problems that exist in their environment.

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