Description of Self-efficacy and Initial Cognitive Abilities on the Students’ Physics Learning of the Direct Current Electrical Circuits

Zaenudin\textsuperscript{1*}, J Maknun\textsuperscript{2}, Muslim\textsuperscript{1}

\textsuperscript{1}Department of Physics Education, Universitas Pendidikan Indonesia, Bandung
\textsuperscript{2}Department of Architecture, Universitas Pendidikan Indonesia, Bandung

*zaenudinzalla@gmail.com

Abstract. This study aims to determine description of self-efficacy and initial cognitive abilities on the students of MAN 1 Bandung (senior high school) in learning physics on the subject of electrical circuits Direct Current (DC) before they get academy ask assigned in the classroom. From the results of this research can be used as a reference to provide appropriate measures for the advancement of student learning. The theory used in this research is the theory of Bandura. The design in this study using case study and data collection is done by tests and questionnaires, sampling techniques used by random sampling, the study was conducted on 10\textsuperscript{th} grade students of MAN 1 Bandung by the amount of students 35 participants. The results of data analysis showed that the percentage of students who have moderate self-efficacy amounted to 67.05 \%, and cognitive ability 50 \%, this shows that the process of learning that takes place in school before that junior high school is not much scientific implement processes that provide students the opportunity to discover new things, then learning approaches of right is Problem Based Learning (PBL).

1. Introduction
Educators who have been in the field of physics sciences complained about the low interest of the students towards subjects of physics science. Data physics enthusiasts at various universities indicate a low interest of prospective students to the science of physics compared with other natural sciences such as mathematics, biology and chemistry. The facts reveal that there physics subjects in school are less attractive because it is too hard, not easy to understand, and too abstract. Because it felt too hard and not easy to understand, the students already feel confident in his ability to understand the science of physics before they are tried or are trying to understand the physics sciences. Through this study the authors attempt to reveal an interest in physics and confidence in his ability learners in the subjects of
physics and its relationship with their achievement in these subjects. The scope of the physics sciences is so vast, both descriptive and theoretical, have made students feel difficulties in studying physics as a whole. These difficulties also have an impact on student learning outcomes are unsatisfactory. Learning successfully in the cognitive domain was also influenced by the affective learners. The affective domain determines the success of one's learning. There are five characteristics that are important in influencing affective learning outcomes of students that attitudes, interests, self-concept, values, and morals [15]. Furthermore, according to Ardhana and Willis that one of the factors that determine student learning outcomes is the concept of self. The self-concept is closely related to the students' self-confidence [12].

According to Carole Wade and Carol Tavris success in mastering the material due to the belief that he has, because of the belief that will cause people to behave in such a way that it becomes a reality [3]. One source is the level of confidence our confidence in the ability of our own (self-efficacy) [3]. Albert Bandura states that self-efficacy is the belief in the ability of self of the individual to determine and implement the actions necessary to produce an achievement, he also noted that the self-efficacy have a significant impact, even as the main motivators to one's success. Self-efficacy by having students will be more likely to do activities that he believed he could do rather than doing the job that they do not think so to finished [1].

Self-efficacy is a person can be based on three aspects. First, the aspect magnitude related to the degree of difficulty of individual tasks. Individuals will attempt to perform a specific task that he can do the implementation and he will avoid situations and behavior that he perceived beyond his limits. Second, the strength aspects related to the strength of an individual's belief in her ability. Hope that a strong and steady on the individual will push for persistent in trying to achieve the goal. Third, aspects relating generality wide coverage areas of behavior in which the individual feels confident about his ability. Individuals can feel confident about her abilities, depending on the understanding that her ability is limited to a particular situation or activity and the range of activities and situations more extensive and varied [1].

Based on the Programe of International Student Assessment (PISA) ranked Indonesia for natural sciences in 2000 are in the order of 38th of the 41 countries, 2003 is in the order of 39th of the 41 countries, 2006 is in the order of 52th (393 points) from 57 countries, in 2009 was in the order of 61 of the 65 countries, the year 2012 is in the order of 64th (382 points) from 65 countries [13], while based on the Trends in International Mathematics and Science Study (TIMSS) ranked Indonesia for Science in 1999 was in the order of 32th of the 38 countries, in 2003 was ranked 36th out of 45 countries in 2007 was ranked 35th out of 49 countries, and in 2011 was in the order of 40th of the 42 countries [6]. The results of TIMSS and PISA low was caused by many factors, including low ability students understand, analyze, communicate a variety of science topics and have not been able to use scientific concepts to make predictions and explain the concepts of science [14].

The new version of Bloom's Taxonomy on the cognitive domain consists of six levels, namely remembering, understanding, applying, analyzing, evaluating and creating. Krathwohl revision is often used in formulating learning goals that are often familiar with the term C1 through C6. Three first level of Bloom's Taxonomy new version of Krathwohl is remembering (recall), understanding (understand), and applying are LOT (Low Order Thinking), while the three next level, namely analyzing, evaluating and creating are HOT (High Order Thinking) [2]. Heong states that HOT is one component of creative thinking ability and critical thinking [8].

Some researchers also successfully showed that confidence self-efficacy relates positively affect academic achievement. A meta-analysis study conducted by Multon & Brown revealed that confidence of success is positively associated with academic achievement [7]. Research conducted by Nugroho entitled "The relationship between self-efficacy, self-adjustment to the students' academic achievement" shows that there is a positive and significant relationship between self-efficacy and academic achievement of students. This shows that the higher self-efficacy, the higher the academic achievement of students [10]. However, this research has not been done for the subjects of physics with the subject electrical direct currents. The purpose of this study was to determine: 1) Description
of self-efficacy 10th class on the subject of electrical direct current circuits. 2) Initial cognitive abilities of the students in the subject of electrical direct current circuits, before being implemented in the classroom.

2. **Method**
The method used in this study is the case study method. This research was conducted in senior high school with research subjects randomly that 10th grade students of MAN 1 Bandung.

Data collection techniques with the form of questionnaires and tests. Questionnaire to determine description of self-efficacy with Guttman scale yes-no, and the test was used to determine the initial cognitive abilities of the students to the subject of direct current electrical circuits before being given a lesson in class.

3. **Research findings**
From the results of questionnaires self-efficacy and initial cognitive abilities are included in this part.

| Table 1. Achieving self-efficacy | Students | Self-efficacy | Classification |
|----------------------------------|----------|---------------|----------------|
| 3                                | <50%     | low           |
| 26                               | 50% - 75% | moderate      |
| 6                                | >75%     | high          |

As in seen at table 1, there are 3 students who have self-efficacy is below 50% (low), 26 students with self-efficacy between 50% - 75% (moderate) and there are 6 students who have self-efficacy above 75% (high).

| Table 2. Initial cognitive abilities | Domain | %    |
|--------------------------------------|--------|------|
| To determine measure of electrical resistance in an electrical circuit | C3     | 100  |
| To analyze a graph electrical potential difference and the strong electrical current | C2     | 68.57|
| To interpret seri-parallel circuits | C2     | 52.85|
| To determine measure of substitute resistor | C3     | 34.29|
| To understand about Kirchhoff's law and determine measure of strong current in a spot branched | C3     | 77.14|
| To understand how to install the measuring instrument AV-meter | C1     | 31.43|
| To use and read the measuring tool on direct current electrical circuit | C4     | 17.14|

As in seen at table 2, initial cognitive abilities of an average is 50%, and the graph shows the phenomenon of the domain ability C1 is lower than the C2, and from the table 2 found 1 student has high cognitive (90%) and self-efficacy is high (80%) and found three students with initial cognitive abilities is very low (20%).

4. **Results and discussion**

4.1. **Self-efficacy level**
From the data findings 10th grade has self-efficacy average of 67.05% (moderate), and if drawn with piechart as follows:
From Figure 1 we can see that most of the students of 10th grade have self-efficacy at low and moderate category in learning physics subject of direct current electrical circuit. This shows that most students do not have confidence in her abilities in defining and implementing learning activities to achieve what has been targeted before in studying physics, despite the fact that there have been several students who have high self-efficacy in the subjects of physics.

Self-efficacy is achieved by students is influenced by three main things: 1) Magnitude: Level difficulty of the task 2) Strength: strength and conviction 3) Generality: activity or behavior that affect the lives of students widely [1], then from this study in general (average) things that affect all three elements of the principal on self-efficacy is as in the table and graph below:

| Aspect                                                                 | score | %    |
|------------------------------------------------------------------------|-------|------|
| 1. Magnitude: level difficulty of the individual task                   | 120   |      |
| 2. Strength: strength and conviction of his abilities                   | 119   |      |
| 3. Generality: activity or behavior that affect the lives of students widely | 95    | 54.29|

From the table and graph above can be analyzed that the self-efficacy of students to the material electrical circuits direct current on aspects of magnitude and strength shows most students do not have confidence in her abilities in defining and implementing learning activities to achieve what has been targeted before in learning, for example the statement about the interest of students to direct current electrical circuit material, most students are not interested in the direct current circuit materials and they assume direct current electrical circuit is a material that is difficult and tedious, 54.29% of those with low self-efficacy being is not like learning with experiment laboratory, but a large part of trying to understand the most complex concepts. An examination of the generality almost the bulk of weaker students in activities that support the process of learning activities, for example, the majority do not read the material that will be given by teacher, but in another statement that the student is the level of efficacy was, for example, the majority of students are always utilize the knowledge from various sources and they always check the answers to work step by step.

In order to understand the physics of matter and the direct current electric circuits especially well, students must also have a high self-efficacy in the subjects of physics. Students with low self-efficacy has not been able to analyze the behavior was going to do well and to increase its efforts to achieve the goal of learning physics. Easy feeling despair or lack of efforts also led the students difficult to find a solution to the problems he faced. Students with low self-efficacy still doubt the ability itself, causing the student to avoid tasks that he considered difficult, before efforts harder to solve. Students who
have the self-efficacy height has three aspects of self-efficacy is also high, and students who have self-efficacy higher will also tend to develop their interest and deep interest in an activity, develop goals, and are committed to achieving that goal. They also increase their efforts to prevent failures that may arise. Students with high self-efficacy who already have confidence in her ability to do their job properly. They have confidence in the face of difficult tasks and feel confident about their ability to solve all the problems it faces. Students are able to analyze the behavior is going to do well and to increase its efforts to achieve learning goals.

4.2. Ability of initial cognitive students

Initial cognitive abilities of the students on average scored 5.00 (50%), there are three students with the high ability to obtain score above 7.00 (8.57%), and 8 students with score below 5.00 (22.85%), and 24 students with the ability to moderate (68.57%). It is like showed with figure 2.

The level of achievement by a student in the school environment is influenced by many factors, including how to teach the teachers at the school in advance (junior high school), curriculum applied, the relationship between teachers and students, students' relationships with students, discipline students in the school, completeness facilities in school and student's readiness to implement learning activities (self-efficacy). From this study, the average initial cognitive abilities of 50%, with the following characteristics: (C1 31.43%); (C2 64.09%); (C3 58.57%); (C4 17.14%), from the chart above, if observed would seem strange, in the realm of understanding (C1) cognitive achievement is lower than the realm of C2 and C3 this is because the Self efficacy is based largely on current students at junior high school for circuit materials electric current processes more learning activities in the classroom (54.85%) than in the laboratory, and they are also aware of the concepts that are not yet understood, C1 is lower than another sphere not only because of these factors also according to researchers because teachers rarely provide material about it.

Learning scientific does not regard the learning outcomes as the estuary end, therefore, on learning of physics must always emphasize process skills, so learners are directed to find out for yourself the facts, concepts, and new values necessary for life, and the skills the process also can not be separated from the practicum, students as a subject of study should be involved in the lab to find the concepts of physics, in this case the material direct current electrical circuit. The concept of an electrical circuit direct current that is already controlled by the students as the results of the study, the majority of students are able to understand the Kirchhoff’s 1st law, then on the next course of senior high school teachers do not need to be revisited, but most students are weak in determining major obstacle replacement a circuit. In the cognitive domain C4 students mostly weak understanding of measuring instruments and also how to apply Ohm's law measuring devices A-V meter, this is because the majority of students during 9th grade on junior high school only given the learning model of conventional.
Like what is presented Shara L in her research that the theory presented Albert Bandura is self-efficacy greatly affect cognitive performance, because it was the students who have experience, good preparation and confidence are able to give input to the attainment of knowledge [16]. This study, the authors intentionally did not discuss the correlation between self-efficacy of students with cognitive abilities early, since the goal of this research is to find a picture of students in the field, so that the results of this research can be done treatment or treatment that is appropriate so as to support the achievement of learning outcomes at a later time. But according to the existing research shows a connection between self-efficacy correlation with academic achievement [4], and this can be interpreted there is significant correlation between the meaningful learning approach and academic self-efficacy so right learning approach is Problem Base Learning (PBL), because in many researches done that Problem Base Learning (PBL) which is fundamentally based on the theory of constructivism, is quite effective method in helping students gain all of these skills [9]. As according pre-service physics teachers meaningful and rote learning approaches, have strong belief in their ability to perform a ask given to them successfully [5], PBL has a wide range of benefits such as being student-centered; helping to student to develop miscellaneous point of view; performing deep; active meaningful learning; and developing problem solving; researching; creative and thinking skills [9] , as the chart results of this study show the relationship between self-efficacy in cognitive performance. Figure 3. Relationships graph self-efficacy with initial cognitive achievement.

Based on the chart above are generally seen pattern is a significant relationship between self-efficacy with prior knowledge of cognitive students on material electrical circuits direct current, although also in this part of the other side are some students who have self-efficacy is high but aspects of cognitive is low, it will likely be because the students do not understand the statement self-efficacy questionnaire. Then it will be better results if this study suggest that an approach also uses triangulation.

5. Conclusion and implication
The purpose of this study is investigate discription of student’s self-efficacy and initial cognitive abilities before they learn about subject discussion of the direct current electrical circuit, so from this study it can be concluded that: (1) Students in 10th grade has self-efficacy with moderate category. (2) The average cognitive ability early on the subject matter of direct current electrical circuit is 50%.

From the data of this study can give implication to us that, (1) understand of initial discription of the students is very important before the students get to get the task of learning, so that the teachers will support the future learning already know the ability of students and teachers can prepare the appropriate method for the material Direct Current (DC), one of the appropriate learning material for direct current electric circuits, it is concluded that the approach scientific Problem Based Learning (PBL), because PBL is more effective than the traditional instruction method in students’ physics
achievements, helping to construct the information and performing the meaningful learning [11]. (2) As a future teacher reference to avoid a repetition of material that once students get the previous class. (3) In order for students to have interest and motivation for learning this, the teacher continues to provide inspiration, and motivation and right persuasion.

References

[1] Albert Bandura 1997 Self-efficacy The Exercise of Control New York W H Freeman and Company
[2] Anderson LW, Krathwohl, DR 2001 A Taxonomy for Learning Teaching and Assessing. A Revision of Bloom’s Taxonomy of Education Objectives New York Addisin Wesley
[3] Carole Wade, Carol Tavris 2007 Psychologi jilid 2 Jakarta Erlangga
[4] Christine Lindströma, Manjula S 2011 Self-Efficacy of First Year University Physics Students: Do Gender and Prior Formal Instruction in Physics Matter? International Journal of Innovation in Science and Mathematics Education, 19(2), 119
[5] Deniz Gurcaz 2013 Investigation of the pre-service physics teacher’s learning approaches Elsevier Turkey procedia social behavioral sciences 106 p1614-1621
[6] Driana, Elin 2012 Menyikapi Hasil PISA Jakarta Kompas
[7] Frank Pajares, Dale H Schunk 2001 Self-Beliefs And School Success: Self-Efficacy, Self Concept, And School Achievement London Ablex Publishing
[8] Heong YM, Widad B O, Jailani MY, Tee TK Razali B H, Mimi MBM 2001 The Level of Marzano Higher Order Thinking Skills among Technical Education Students International Journal of Social Science and Humanity Vol.1 No. 2
[9] Korkmaz H 2002 Fen egitiminde proje tabanlı öğrenmenin pratikCUS ve akademik risk alma unpublished dissertation hacetep university Ankara turkey
[10] Nugroho 2007 Hubungan antara Self-Efficacy Penyesuaian Diri dan Prestasi Akademik Mahasiswa https://lib.atmajaya.ac.id/DesktopModules/Admin/Logon.aspx?
[11] Pinar Celik, Fatih Onder, Ilhan Silay 2011 The effects of problem-base learning on the students’ success in physics course Elsevier turkey procedia social behavioral sciences 28 p656-660
[12] Purwaningsih DD 2007 Pengaruh Konsep Diri Siswa terhadap Hasil Belajar Mater Bangun Ruang Siswa Kelas VIII SMP Negeri 16 Semarang Availabe: http://digilib.unnes.ac.id/ gsd/SKRIPSI/index/pdf.
[13] Puspenskid 2011 Instrumen Penilaian Hasil Belajar Matematika SMP Belajar dari PISA dan TIMMS Jakarta Puspenskid, Balitbang Depdiknas
[14] Puspenskid 2015 Analisis Laporan PISA dan TIMMS 2010-2011 Jakarta Puspenskid
[15] Sudrajat A. 2008 Pengembangan Perangkat Penilaian Afektif http://akhmadsudrajat.files.wordpress.com/2008/08/penilaianafektif
[16] Shari L. Britner, Frank Pajares. 2006 Sources of science self-efficacy beliefs of middle school students. Journal of Research in Science Teaching Vol 43, Issue 5, p485–499