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Teaching "Changes in Electrical Energy to Light" to Students with Intellectual Disabilities in Junior High School

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Abstract--- *This study aims to find out how to teach changes in energy (electricity to light energy) in daily life to students with intellectual disabilities. This study uses a single subject research (SSR) approach with pre-test and post-test. The sub-jects of this study were three students at Bandung Extraordinary School. Teaching is delivered using an experimental demonstration method. The experimental demonstration is carried out by observing the changes in the form of electrical energy into light energy in series and parallel electrical energy. The results showed that difficult subjects, such as the change of energy from electrical energy to light energy can be taught to DHI students. As many as 67% can understand the material being taught. The reason for achieving success is because using the experimental demonstration method helps DHI students easily understand the subject matter. DHI students find it difficult to understand a complex and abstract concept. Thus, to understand what the teacher has taught learning must be made as attractive as possible according to the needs of children.*

Keywords: *students with intellectual disabilities; energy change; education; teaching.*

I. INTRODUCTION

Teaching about changing electrical energy into light energy in series and parallel circuits is one of the science learning taught at school. The process of changing electrical energy into light energy is often encountered in daily life, but sometimes we are not aware of it. Studying the change of electrical energy into light energy is very important, because it has many benefits in everyday life. For example, changes in electrical energy in light energy in an electrical circuit greatly affect the darkness of light [1]. Installation of electrical circuits in the conversion of heat energy into light energy greatly affects the light produced. Voltage or source of electrical energy also greatly affects the bright light produced by the lamp. For students with intellectual disabilities it is difficult to under-stand the principles of complicated and abstract concepts. They have the characteristics of easy to forget and need repetition in learning. Thus, **students** need

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methods and media that are simple, concrete and interesting in the process of learning to change electrical energy into light energy. Many studies discuss energy changes in series and parallel electrical circuits. But the research discusses complex concepts, such as the installation of solar panels on poly crystalline in series and parallel circuits and is taught to general students [2]. Learning about the experiment of changing electrical energy into light energy by comparing these experiments in series and parallel circuits is indeed often done.

But it is very rare for researchers to try to change electrical energy into light energy in children with intellectual disabilities. One reason is that many teachers have difficulty dealing with children with intellectual disabilities. Most teachers do not believe that they are able to teach children with intellectual disabilities [3]. Especially in learning science experiments energy changes that are considered quite complicated. Many factors affect the learning process of students both external and internal factors [4].

Previous research on teaching nanotechnology in children with hearing impairments also used experimental demonstration methods to teach science learning that was quite difficult [5, 6, 7]. But we used the experimental demonstration method in teaching energy change electricity becomes light energy for students with intellectual disability. An interesting, concrete learning process is really needed by students with intellectual disability, because they have difficulty learning something abstract. Innovation in learning is needed to be a solution of problems in the world of education [8].

Teaching difficult subjects to students with intellectual disabilities is a fairly complicated problem. Teacher knowledge is still limited and the lack of creativity and innovation of teachers in the learning process is one of the factors. In addition, students with intellectual disability have the characteristics namely; Low IQ less than 70, has problems in adaptive behavior, and low academic aspects. During the learning process students find it difficult to concentrate. This is what imposes reports on teaching science subjects that are considered difficult to find, because research-ers will have difficulty handling the characteristics of Students with intellectual disability.

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Therefore, the purpose of this study is to find out the appropriate method used for learning to convert electrical energy into light energy for students with intellectual disability. We also consider the factors that influence student learning achievement with intelligence barriers are very important. Efforts are made to minimize the problems of teaching and learning process (due to obstacles and problems of students), we limit this research to the importance of changing electrical energy into light energy in everyday life. This research is very important because although several re-ports have shown methods to teach the trans-formation of electrical energy into light energy to junior high school students with intellectual disabilities, it is very difficult to find studies related to teaching these subjects.

II. MATERIAL AND METHODS

2.1 Materials

In our daily lives we need a lot of energy, one of which is electricity. Electrical Energy is a main energy that functions for electronic equipment in which stored Electric Current with Unit Ampere (A), Electric Voltage with a Unit of Volt (V), and the provisions of the need for Electric Power Consumption with Walt Unit (W). The formulas in electrical energy are as follows:

$$W = V.I.t \quad (1)$$

Where *W* is electrical energy, *V* is the voltage, *I* is the strong current and t is time.

The electricity produced can be turned into energy. There are several types of energy changes, one of which is the change in energy from electrical energy to light energy. A concrete example in daily life can be seen in the light bulb when it is on. The dark light of the lamp is influenced by several factors, including the series of electric current flow. Children in general are very easy to understand that there are two electrical circuits, namely series and parallel circuits. But for students with intellectual disability it is very difficult to understand.

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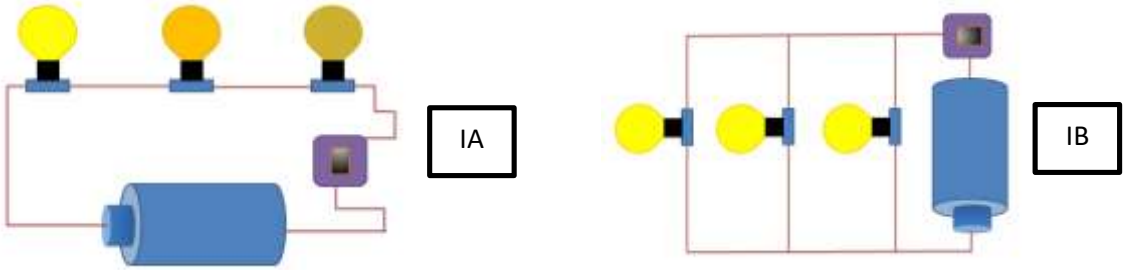

Figure 1. Serial and Parallel illustration

Figure 1 A illustrates the series of electric current series. Where the series circuit arrangement looks simply, the series arrangement does not have a series of branches. The flow of electricity from a voltage source (such as a battery) will lead to obstacles with one cable. So that there is only one cable that connects the electrical resistance in a straight line.

Fewer series components, the use of components used is only a source of voltage, cables and obstacles. If in real life, such as voltage sources, switches, cables and light bulbs as needed. Looking for strong currents in a series of circuits that are series circuits the amount of electric charge flowing in each obstacle is the same, so that the resistance at one point will be the same as at another point. For this reason, the formula is obtained: $I = I_1 = I_2 = I_3 = I_4$.

The strength of a series voltage, as explained above that in a series of potential energy or voltage cannot be equated in value as only with the strong current. To find the amount of potential energy or total voltage is to use the following formula: $V = V_1 + V_2 + V_3 + V_4$. The number of series resistance in a series is the sum of all obstacles in the electrical circuit. With the formula, namely: $R = R_1 + R_2 + R_3 + R_4$

Figure 1 B provides an illustration of the parallel current range of electric current. Where parallel circuits look more complex. This happens because of the branching in the circuit. So that not only will be seen one whole cable. But there is a division of current direction that occurs towards obstacles that are no longer located in a straight line like a series circuit.

Parallel circuits use more components. However, for parallel circuits it has a greater number of components. More switches than in series, and longer cables [9]. Looking for strong currents in parallel circuits, whereas in parallel circuits the count to find the formula

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for strong currents is not the same as in series. However, the total current strength in a parallel circuit is the result of adding a current to the resistance. So we get the formula: $I = I_1 + I_2 + I_3 + I_4$.

The strength of a parallel circuit is that the voltage measurements on a parallel circuit are the same for all points. The total potential energy will be the same value as the potential energy that is at all points. In order to obtain the following formula: $V= V_1 = V_2 = V_3 = V_4$

Large resistance of parallel circuits: the resistance in parallel electrical circuits is not the same between one point. This happens because in parallel electrical circuits occur branching. So, the formula for looking for total obstacles is: $1/R = 1/R_1 + 1/R_2 + 1/R_3 + 1/R_4$.

In comparison child without intellectual disability in the same grade told that "It is not so difficult to understand how the serial and parallel in the circuit lamp has different light brightness and why it is different." Whereas, Child with intellectual disability has told: "I do not know what the difference between serial and parallel in the circuit lamp and why it is different." Based on the interview to one student with intellectual disability and one student without disability from different school. Person with intellectual disability are characterized by significant limitations in cognitive functioning and adaptive behavior [10]. A major issue in the field of intellectual disabilities is the development of appropriate individualized support that should be differentiated in accordance, among others, to the specific difficulties and the potential that characterizes a person with intellectual disability. Undoubtedly, the reliable assessment of the individual characteristics of people with intellectual disability in cognitive and behavioral level is of great and critical importance, considering both competencies and limitations, in order to appropriately organize and adapt the support provided, as well as the c-ontent of the educational programs and interventions [11].

2.2 Method

2.2.1 Research subjects

This study uses a single subject research (SSR) approach, which focuses more on limited research subjects (i.e., subjects changing electrical energy to light energy) and can be

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replicated for future research. The study participants were three students with intellectual disability at the Purnama Asih special lower secondary school (SMPLB) in Bandung, Indonesia. This school is only for students with special needs. In other words, students with intellectual disability are not mixed with other students in the teaching and learning process. Teaching is delivered using the experimental demonstration method. Then, to improve student understanding, we conduct teaching with simple experimental demonstrations with concrete media.

In addition, to get basic information from students, such as IQ levels, demographic information, and their basic knowledge abilities (i.e., mathematics, social sciences, natural sciences, Indonesian, and Islamic religion), interviews with school teachers were con-ducted. The data collected is then used to develop research instruments. To simplify the analysis of students' level of ability, all information is assessed using a 5-scale score of 0 (can't do anything), 1 (not good enough), 2 (not good) 3 (good enough), 4 (good), 5 (very well).

2.2.2 Condition of teaching

Teaching is carried out in 2 sessions. The first session uses the lecture method only and the second session uses the lecture method, discussion and demonstration experiments. Each session is conducted in class for 60 minutes. To simplify the process of teaching energy change, we provide information only about energy changes in everyday life. To get information on student understanding, the teaching process is completed with a pretest and posttest (through interviews).

The first session teaches students the importance of knowing energy changes in everyday life, while the second session is an experimental demonstration of the change of electrical energy into light energy in series and parallel circuits. An experimental demonstration was conducted to provide an understanding of why the series of lights that are lit are not as bright and the electrical energy used does not run out quickly.

In addition, in an experimental demonstration we use solar cells to attract students' attention about electrical energy sources.

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2.2.3 Experimental demonstration

Experimental demonstrations are carried out by assembling tools and materials for se-ries and parallel circuits. We use solar cells and brick as a source of electrical energy. We use 6 light bulbs (2,5 volt 3 ampere Philips from Koninklijke Philips N.V), 3 of which are assembled in series and the third in parallel. Copper cable fiber etterna brand arrange on printed circuit board with a thickness of 0.25 cm and an area of 9.5 cm to 7.5 cm as can see in the figure 2.

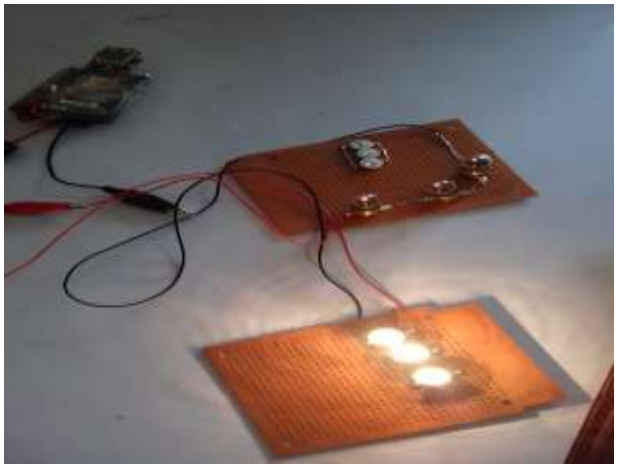

Figure 2. Parallel and serial circuit tools

In the first parallel circuit we strip the end of the cable and attach it to the lamp socket then solder it (connect to 3 parallel lamp sockets). We connect the other end of the cable to the stone socket, then attach the lamp to the socket that is already connected to electricity. After that students are asked to observe what happens.

In the first series we strip the end of the cable and attach it to the lamp socket then solder it (connect it to the 3 serial light sock-ets). We connect the other end of the cable to the stone socket, then attach the lamp to the socket that is already connected to electricity. After that students are asked to observe what happens.

In addition, students are asked to observe and compare the differences in light that occur in 2 series of parallel and series lights (Series X and Y). Observe changes in the energy of bright light in each series and parallel lamp series.

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III. RESULTS AND DISCUSSIONS

3.1 Student Demographics

Figure 3 shows the demographic data of students with intellectual disability. There is five information displayed from students aged 15 to 16 regarding the diagnosis of DHI students, emotions, language, communication, academic and motor skills. This information is very important to know because it illustrates the extent of the ability of IQ and student development, as a basis in carrying out the teaching process so that students can understand the material being taught. Students who experience intellectual disability have an IQ level of less than 70 which makes it difficult for them to understand the material being taught.

Student #1 and #2 has a level of emotions, language, communication, and motor skills at level 3, this means that the development of emotions, language, communication and motor skills of students is quite good. Students are quite able to control their emotions during the learning process, students have good enough language and communication skills and easy to understand pronunciation, and students can do fine and gross motor activities quite well in the learning process. However, the academic aspect of student #1 is at level 2 which means that the aspects of reading, writing and arithmetic students are not good. New students are able to write with a dictation by letter, students are also only able to read and recognize letters in the numeracy aspect students are able to count and recognize numbers 1 to 10 and/or 1 to 15.

Student #3 has an emotional level, at level 3, this means that the emotional development of students is quite good. Students are quite able to control their emotions during the learning process. Aspects of language, communication and motor skills of students are at level 2, which means that students' language and communication and motor skills are poor in the learning process. However, the academic aspect of student #3 is at level 1 which means that the aspects of reading, writing and arithmetic students are not good. New students are able to connect the dotted lines in the writing aspect, students are also only able to recognize vowels and several consonant letters in the numeracy aspect students are able to count 1 to 7 and recognize symbols of numbers from 1 to 1.

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Conclusions from previous observations, the level of student ability has been explained. If the classification from high level to lowest level is done, the researcher concludes the sequence is Student # 2, Student #1 and Student #3.

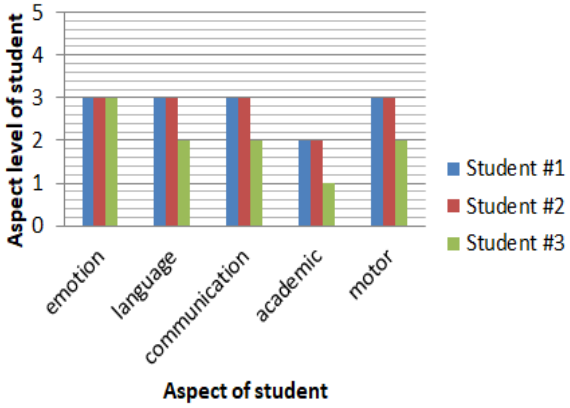

Figure 3. Data about Student Conditions

Figure 4 shows the level of understanding of children in the subject of learning sub-jects taught. There were five subjects observed, namely Indonesian language, social science, science, Islamic religion and mathematics. This information is very important in knowing students' readiness to participate in learning in cognitive aspect. Children with intellectual disabilities experience a cognitive deficit and this is reflected in one or more cognitive processes such as: perception, memory, idea development, evaluation, and reasoning [11]. However, there are di-verse level between one child with intellectual disability to another.

Each student has different characteristics Students #1 and #2 have more interest in social science and natural science subjects than other subjects. Student #3 who has less understanding than others shows interest in mathematics and religion. Although there is a relationship with student IQ, the effect is not so great. The results confirm that interest in one subject from another seems to stem from curiosity and student satisfaction.

The succesful implementation in different education setting of specific methods and practices in science education for students with intellectual disability, as well as the development of appropriate adaptations, in accordance to the students' difficulties and

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competencies, has a direct relation to the special education teacher's training and preparation [13, 14]

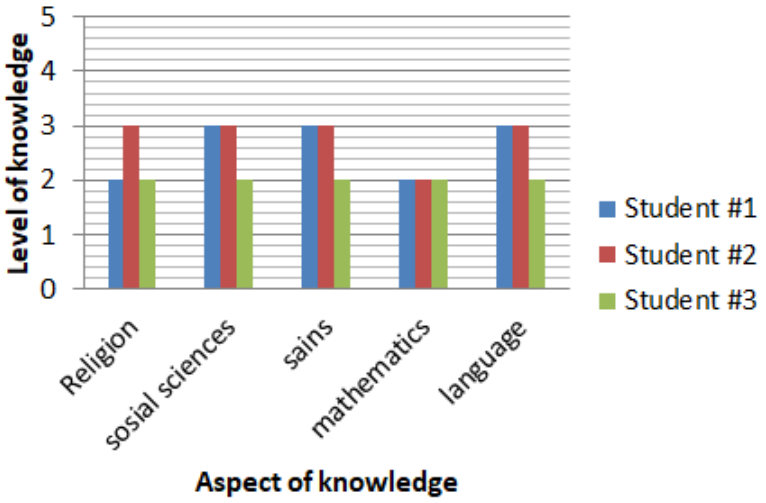

Figure 4. Student Knowledge Levels in Subjects

Students have new experiences with demonstrations of the change in electrical en-ergy into light energy. Students observe the energy changes in the process of the lights on in series and parallel using the electric energy source stone. There are various differences in parallel and series electrical circuits in terms of resistance, strong current and voltage. Electric power also affects the energy changes that occur in series and parallel series, as for the formula as follows:

$$P = W/t \quad (2)$$

Where *P* is electrical power, *W* is electrical energy, and *t* is time.

We explain the advantages and disad-vantages of series and parallel circuits. In each series of electric currents certainly have ad-vantages and disadvantages of each. So that the election can be adjusted to the needs that exist. The advantage of series and parallel circuits is that series circuits use fewer com-ponents than in parallel circuits. Has a faster detection ability when damage occurs. As well as having a strong electric current flowing is the same. as well as saving more electricity. While the parallel circuit has the advantage that if one obstacle has

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an effect it will not create problems in the other obstacle. Has the same potential energy at each point of the cir-cuit. When used in the installation of a bulb in a series, the light bulb does not differ between the closest to the farthest from the voltage source.

Weaknesses that even the two electrical circuit arrangements have different weakness-es. These weaknesses are influenced by voltage, current strength and resistance in the circuit. Can be explained as follows, the weakness of the series circuit has a different potential energy so that when used in a series of bulb gives a different flame. The farthest bulb from the voltage source has a fainter flame. Due to having one source of electricity so if one lamp dies cause all lamps also die. The disadvantage of parallel circuits is that they are more wasteful of electricity and use of constituent lamps. They have different current strengths from one point to another.

Above is an explanation of the different series and parallel circuits in various aspects. In addition to the two series, there is a mixed circuit which is a combination of the two series. Recognizing these two electrical circuits will be able to determine the right choice in arranging the electrical circuit according to its use.

Cognitive and metacognitive difficulties related to thinking processes, with which people with intellectual disability usually deal, as well as their personality characteristics related to motivation factors, pose certain critical questions regarding the adequate choices about the content, goals, materials, methods an practices and the learning procedures in science teaching to students with intellectual disability [12].

3.2 Teaching Process

Based on the demographic data above as well as the IQ and basic knowledge of stu-dents, we find the complexity of DHI student learning to get academic achievement. Thus, we limit learning to the transformation of electrical energy into light in daily life as a main subject. At the very least, we can give students an understanding of the basic concepts of what energy changes.

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The results showed that the change of electrical energy into light can be taught to students intellectual with disability. Teachers must be skilled in teaching technology-related topics so that students' level of understanding increases, because students intellectual with disability have low IQ levels compared to students in general. Special techniques for teaching are also needed because the focus and concentration of students intellectual with disability to learn something is limited and easily destroyed. As such, they cannot absorb effectively using the usual teaching and learn-ing process.

After delivering the subject of changing electrical energy into light, we found data:

a. In the first 35 minutes of the session, because teaching was delivered using the lecture method the students seemed uninterested. The level of student understanding is questioned.
b. During simple experimental demonstrations students begin to be interested and pay attention with enthusiasm. This can increase student interest. Specifically, when students try to assemble and turn on lights.
c. Additional simple experimental demonstrations increase the level of student understanding, compared to conventional teaching with the lecture method only.
d. The results of the study show that the way of teaching that suits students' needs is very effective in increasing student understanding.

From the above results, the teaching process for DHI students requires special techniques. Specifically, teachers need to pro-vide interesting methods and media to attract students' concentration and focus. Otherwise, the level of student understanding cannot be predicted.

To ensure students' level of understanding during the teaching process, a final test on the change of electrical energy into light is given to DHI students from elementary to intermediate level questions. Table 1 shows some questions related to the conversion of electrical energy into light energy in series and parallel electrical circuits given to students. As a model, we ask thirteen questions. More specifically, questions related to the process of turning electrical energy into light, to confirm the impact of additional experimental

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demonstrations on improving student understanding, we compared the results of the teaching process with (W) and without (W / 0) additional experimental demonstrations.

Least certain apects of science education could have a critical value in everyday lives of childrent with intellectual disability [11, 15]. The connection of accademic content to real life experiences, as well as community based intruction, have had in most cases a positive impact on learning and new skills aacquisition by childrent with intellectual disability.

Table 1. Questions about the demonstration of changes in electrical energy into light energy

No	Question	Student 1		Student 2		Student 3	
		W0	W	W0	W	W0	W
1	Is electricity one of the energy?	2	4	2	4	0	3
2	Is the battery a source of electrical energy?	0	3	0	3	0	2
3	Is solar cell a source of electrical energy?	0	3	0	3	0	2
4	Is the electric energy in the battery / solar cell able to make a light bulb become radiant?	0	3	0	3	0	2
5	Is light one of the energy?	0	4	2	4	0	3
6	What does it take to make the light bulb turn on?	0	4	0	4	0	3
7	Are each lamp in the parallel circuit lit not as bright?	0	3	0	3	0	2
8	Are each lamp in the series lit up equally brightly?	0	3	0	3	0	3
9	Do the lights in the series near the positive pole of the battery turn brighter?	0	3	0	3	0	2

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10	Do the lights in the parallel circuit light up brighter than the lights in the series circuit?	0	3	0	3	0	2
11	Do parallel lights use up more power in the battery?	0	3	0	3	0	2
12	Do all the lights in the series die when one of the bulbs dies / is short?	0	3	0	3	0	1
13	Do the lights in the parallel circuit stay on when there is one light bulb that is dead / shorted?	0	3	0	3	0	1
Scor		2	42	4	42	0	28

*Note: W is teaching process with experimental demonstration and W0 is not experimental demonstration

Student #1 and student #2 initially did not understand about the change of electrical energy into light energy, they only understood that battery and light are one energy. After learning with the experimental demonstration method students #1 and student #2's under-standing of the change of heat energy into light has increased. This can be seen from the acquisition of a score of 42 or approximately 65% of the maximum score of 65, student #1 and student #2 answer correctly when asked a question.

Student #3 initially did not understand about changing electrical energy to light en-ergy. After learning with the experimental demonstration method students' understanding of changes in electrical energy into light energy has increased. This can be seen from the acquisition of a score that initially 0 (pretest) increased to 28 (post-test) or approximately 47% of the maximum score of 65, student #3 correctly answered several questions when asked questions.

Students learn very enthusiastically when using the experimental demonstration method coupled with learning media that are tailored to the needs of children. Most stu-dents after learning by using the experimental demonstration method can understand the change of electrical energy into light energy. Two out of three students or 67% have an answer score of

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more than 64% of the maxi-mum score. In line with the above findings [9] argue: Choosing the appropriate instructional methods and practices should be directly associated with the needs, the limitations and the potential of every individual student with intellectual disability. Actually, in the process of intervention planning not only the cognitive limitations of the children with intellectual disability should be emphasized, but their potential as well.

3.3 Qualitative Analysis

All students showed improvement in understanding learning about changing elec-trical energy into light energy. See the expla-nation in table 1, 67% of students have in-creased understanding. In the learning process, the first session of student #1, student #2, and student #3 were given thirteen questions as one of the student's pre-test data. Almost all questions cannot be answered by student # 1, student #2, and student #3 students answer carelessly. The question was repeated three times. Student #1 and student #2 only know about different types of energy. When asked the question "is electricity a source of energy" Student 1 replies "yes ma'am ... electricity is energy, there is a solar lamp", student #2 an-swers "yes ma'am, electricity is energy". Meanwhile, student #3 answers "know Mom ... ". Student #3 looks more passive and always follows and repeats the question, it's all be-cause student #3 has lower academic ability than student #1 and student #2.

Each student is asked to strip the end of the cable and attach it to the lamp socket then solder it (connect it to 3 serial and parallel lamp sockets). Student #1 and student # 2 strip the cable with scissors quite well, but student #3 is in a hurry. Students connect the other end of the cable to the stone socket socket, then plug the lamp into a socket that is already electrically connected alternately. Student #3 is able to pair and follow instructions with the help of the teacher. After that students are asked to observe what happens.

In addition, students are asked to ob-serve and compare the differences in light that occur in 2 series of parallel and series lights (Series X and Y). Students observe the changes in the energy of bright light in each series and parallel series of lights and observe which batteries are quickly depleted of elec-trical energy.

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After the learning process in the second essay the students were given thirteen ques-tions the same as the questions in session 1 with three repetitions. All students showed increased understanding of the change in elec-trical energy into light energy. Although the level of understanding of student #3 is still below 50% the maximum score. That is because student #3 has focus and concentration that is easily distracted and academic abilities are less good compared to student #1 and student #2

IV. CONCLUSION

The results of this study indicate that difficult subjects (such as the change in elec-trical energy into light energy) can be taught to students with intellectual disabilities. To increase the level of understanding, the teacher must repeat the teaching topic many times. How to do repetition can also be done in experiments. Some things that must be considered such as learning methods and the media used must be made as concrete and attractive as possible according to the needs of children. Indeed, the support of a simple experimental demonstration is very helpful to increase the level of understanding.

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REFERENCES

[1] Spataru, S. V., Sera, D., Hacke, P., Kerekes, T., & Teodorescu, R. (2016). Fault identification in crystalline silicon PV modules by complementary analysis of the light and dark current–voltage characteristics. Progress in Photovoltaics: Research and Applications, 24(4), 517-532.

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[2] Boyd, M. T., Klein, S. A., Reindl, D. T., & Dougherty, B. P. (2011). Evaluation and validation of equivalent circuit photovoltaic solar cell performance models. Journal of solar energy engineering, 133(2), 1-13.
[3] Shade, R. A., & Stewart, R. (2001). General education and special education preservice teachers' attitudes toward inclusion. Preventing School Failure: Alternative Education for Children and Youth, 46(1), 37-41
[4] Smilansky, J. (1984). External and Internal Correlates of Teachers'satisfaction and Willingness to Report Stress. British Journal of Educational Psychology, 54(1), 84-92.
[5] Nandiyanto, A. B. D., Asyahidda, F. N., Danuwijaya, A. A., Abdullah, A. G., Amelia, N. I. A., Hudha, M. N., & Aziz, M. (2018). Teaching "Nanotechnology" for elementary students with deaf and hard of hearing. Journal of Engineering Science and Technology (JESTEC), 13(5), 1352-1363.
[6] Hidayat, D. S., Rakhmat, C., Fattah, N., Rochyadi, E., Nandiyanto, A. B. D., & Maryanti, R. (2020). Understanding Archimedes Law : What the Best Teaching Strategies for Vocational High School Students with Hearing Impairment. Journal of Technical Education and Training, 12(1), 229–237.
[7] Widodo, A, P, A., Hufad, A., Tukimin, S., & Nandiyanto, A. B. D. (2020). Colaborative Teaching in Heat Transfer for Slow Learner Students. Journal of Engineering Science and Technologi, 15(Special Issue 1/2020), 11–21.
[8]Nurdyansyah, N., Rais, P., & Aini, Q. (2017). The Role of Education Technology in Mathematic of Third Grade Students in MI Ma'arif Pademonegoro Sukodono. Madrosatuna: Journal of Islamic Elementary School, 1(1), 37-46.
[9]Widjayanti, W. (2007). Profil Konsumsi Energi Listrik Pada Hunian Rumah Tinggal Studi Kasus Rumah Desain Minimalis Ditinjau Dari Aspek Pencahayaan Buatan. Enclosure, 6(2), 97-106.
[10] Schlosser, N., Wolf, O. T., & Wingenfeld, K. (2011). Cognitive correlates of hypothalamic–pituitary–adrenal axis in major depression. Expert review of endocrinology & metabolism, 6(1), 109-126.
[11] Rillotta, F., Arthur, J., Hutchinson, C., & Raghavendra, P. (2020). Inclusive university experience in Australia: Perspectives of students with intellectual disability and their mentors. Journal of Intellectual Disabilities, 24(1), 102-117.
[12] Knight, V. F., Huber, H. B., Kuntz, E. M., Carter, E. W., & Juarez, A. P. (2019). Instructional practices, priorities, and preparedness for educating students with autism and intellectual disability. Focus on Autism and Other Developmental Disabilities, 34(1), 3-14.
[13] Scott, B. J., Vitale, M. R., & Masten, W. G. (1998). Implementing instructional adaptations for students with disabilities in inclusive classrooms: A literature review. Remedial and Special Education, 19(2), 106-119.
[14] Mercer, C. D., Lane, H. B., Jordan, L., Allsopp, D. H., & Eisele, M. R. (1996). Empowering teachers and students with instructional choices in inclusive settings. Remedial and Special Education, 17(4), 226-236.

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[15] Kersh, J., Hedvat, T. T., Hauser-Cram, P., & Warfield, M. E. (2006). The contribution of marital quality to the well-being of parents of children with developmental disabilities. Journal of intellectual disability research, 50(12), 883-893.

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