American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-7, Issue-10, pp-01-04
www.ajer.org
Research Paper Open Access

Development of Tools for Utilization of Motion Energy to Electricity for Science Media Learning

Nurgan Tadeko[1], HeruKuswanto[2], DyahAyu Kristanti[1], Avisia Suryaningtyas[1],
[1]*Postgraduate student in Science Education, Yogyakarta State University*
[2]*Doctor, Associate Professor at Physiscs Education Study Program, Yogyakarta State University*

ABSTRACT :*The purpose of this tool's development is to result media learning for laboratory activity that can give general picture on the use of biomechanics to generate electricity and can be utilized by the students. The final result of the development is to get media which can generate electricity for 0.017 Volt after running as 28 meters and 2.426 Volt for 24.5 meters.*
Keywords -*Motion Energy, Science Media Learning*

Date of Submission:02-10-2018 Date of acceptance: 13-10-2018

I. INTRODUCTION

The 21st century requires students to have certain skills. Those what we called as 21st century skills are life and career skills, learning and innovation skills, as well as information, media and technology skills [1]. In regards to that demand, learning natural sciences as one of main subjects shall direct the learning process to achieve those skills. The 21st century achievements should not only teach about the concepts without teaching how the concepts could be applied in our daily life.

Learning process by applying concepts of science in daily life is really important. It aims to be a more meaningful science learning for students, as a result they will love to study sciences due to the fact that the learning process is really close with their routines and it is beneficial for their life. Besides, by teach students about the concepts can direct them to develop 21st century skills.

Application of science concepts can be taught through practical activities or simple research. Whereas practicum or simple research will enable students to apply skills or practice the processes of science. Thus, it is possible the application of a variety of science process skills that can develop 21st century skills, while at the same time supporting the development of a scientific attitude in the process of acquiring student's knowledge. This kind of learning process is expected to create future generations who are ready to face the world's challenges after studying sciences and get used to apply scientific methods.

One of the problems faced by students is related to addiction on smartphone. As we already know that our students use smartphone for games, social media, as well as other digital activities. Data from Nielsen Company [2] shows that more than 70% teenagers have cellular phone. The high number of mobile phone's use among students demands the energy availability. Yet, not all of students have power bank devices and there is shortage of charging spots. In regards to this issue, learning process can be directed to solve the problems of energy availability.

There are studies address on the provision of alternative energy. One alternative energy that interested to be studied is biomechanics. Biomechanics is a sub-discipline of sciences related to the application of the principles of physics, it is studying motions or movements in any part of human body [3]. It becomes interesting since it integrates biology and physics which is associated with the motion to produce electricity. Studies have been developed related to this subject, as a research by Donelanet al. [4] that deals with the Biomechanical Energy Harvesting: generating Electricity During Walking with Minimal User Effort that means when we are walking there will be electricity produced. The research results tools installed on human's knee and it will generate electricity while we swing the leg. It is explicitly mentioned that this kind of tool is suitable to be utilize in portable devices. A research by Young-Man Choi et al. [5] also explains that generate a few watts of power is important and would be beneficial to charge portable electronic devices such as mobile phone and laptop. Study by Schertzer&Rierner[6] explains that there is study of harvesting energy from human's

movement as the alternative energy. In Indonesia, there is study developed entitled Utilization of Bicycle for Mobile Phone Charging by Putri et al. [7] whereas this study explains that motions from bicycle can be transformed into electricity, it also can be used to charge mobile phone with battery specification of 780 Ma from 10% to 30% in 15-16 minutes. According to that journal, therefore the development of tools for generating electricity by using biomechanics is possible. However, since it is for student's practice the tools should be simplified and easy to find.

II. MATERIALS AND METHODS

Tools needed for this experiments are: (1) Generator, (2) Gear from Tamiya (3) Shoot glue (4) Two dowel, (5) Portable fan activator, (6) Strap, (7) Window hinge, (8) Powerbank device, (9) USB cable, and (10) Multimeter. The following image shows the sequence:

Figure 1. Tools for generating electricity with biomechanics

Steps to make this tool is stringing all of the equipment as in Figure 1. Two dowels connected by window hinge. Then above the hinge should be affixed with fan activator. Furthermore, the top side of it must be connected into a generator, connect the USB cable and Tamiya's gear. And finally connect the strap to the dowel.

The principle of this tool is whenever the tool is installed in the side of knee, therefore the tools will move following the leg's movement while we are walking. The leg's movement will make the dowel move and the affect on the fan strap. Whenever the fan is moving, so the gear that installed inside fan mover will spin and make the Tamiya gear above move as well. The movement of those gears will makes generator spin. Generator is a tool to transmit mechanics energy into electricity [8]. The principle of generator is spin the coil inside the magnetic area and/or spin the magnet inside the coil. Generator in this part are a fixed coil and a magnet that can spin. Generator will spin whenever the leg is moving and it will affect the interconnected gears so that the magnet will be spin as well. Magnet's moving will generate electricity. The following image is the series of gears on the tool:

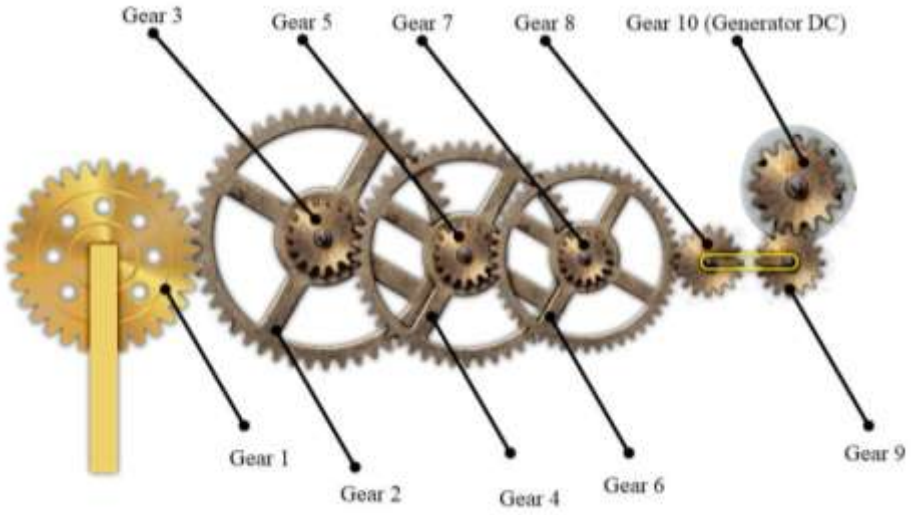
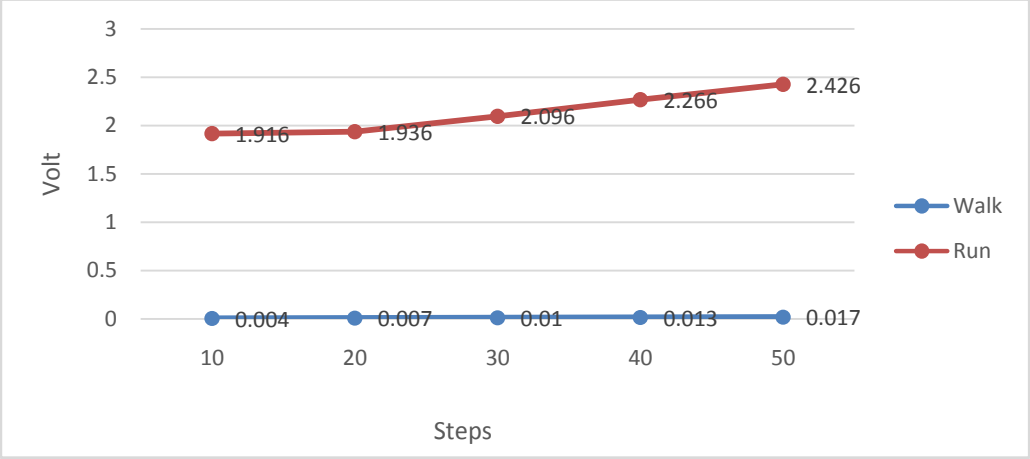


Figure 2. The gear set on the biomechanics electricity generator

III. RESULT

After the tool has been developed, to know whether or not his tool can be well-functioned we need to take tests toward the tool. In the experiments there are variable changed such as foot steps while walking and running. There is difference footsteps and distance while we are running and walking. On this experiments one footstep is 56cm on walking, and 69cm while running. The result of the test is as follow:

Chart 1. Experimental Results of Biomechanics Electricity Generator



IV. DISCUSSION

Some movement on human's body can indicate a biomechanics principle. Biomechanics is a study of the function and structure of the human body whenever it moves. Knee is one of the very important biomechanical function. Biomechanical function of the knee can be seen when we are running and walking. At the time of people walk or run there are flexion and extension, in which flexion occurs when the legs bend and extension happens whenever the leg is in the straight position.

When people walking there will be positive mechanical work, in which the active muscle fibers shorten as the body moves to the front. This activity transforms chemical energy that is metabolic energy into mechanical energy. Knee as a part of working system act directly as the tool to move the gear lever in the tool. Gear that is connected directly to the DC generator will generate DC electric voltage whenever the foot moves in a state run. Electricity that result in this activity is a temporary energy, where the voltage is not constant. Therefore, storage is a key on this instrument, that will able to save the small energy though. Storage that used in this study is a powerbank device. This device will save the electricity generated when we walk or run. After the energy saved, then the powerbank should be connected to multimeter measure how much electricity generated. In principle, the farther person walks or run the more energy produced.

The result of the tests on this tool generate electricity as shown in Chart 1. The chart shows the farther person walks or run the more energy produced. However, the more footsteps when we run will indicate farther distance, therefore the electricity generated is much higher. On the Chart 1 indicates people run can generate more electricity than walk. It is because when we run the distance of one footstep is longer and the leg muscles works harder. The result of the test shows us that by using simple tool students can generate their own electricity that can be utilized for charging.

Learning process of natural sciences by doing practical or simple research related to the application of the concepts of sciences is expected to make more meaningful science process. In addition, students become more interested since realize that what they learn brings benefits for their daily life. This kind of learning process will also develop critical and creative thinking skills of students, because they try to resolve the problems. Biomechanics electricity generator can be one example of the creation of alternative electrical energy that can overcome the electricity shortage issue. Teachers and students can develop this tool by using improved equipment to create bigger voltage of electricity or to find other alternative energies. Learning process through practicum activity will result new friends and connections, so that the students will always think critically and creatively to answer the findings during practicum activities.

V. CONCLUSION

1. This research produced an equipment which changes motion energy to electrical energy using cheaper and easy to get materials.

2. The equipment produced voltage 0,007 volt when it walked by velocity 0,38 m/s in once step.
3. The electrical energy would be increased when the human who using this equipment walked faster.

ACKNOWLEDGEMENTS

The writer would like to express his great appreciation to everybody who have helped during this research; which give probability in developing the equipment to a learning medium. Developing this equipment is the form and the result from biomechanical research by using the less finance. Therefore, the writer expresses his thanks to the supervisor who have given their suggestions, critics and acluices during the completion of this journal

REFERENCES

[1]. Partnership for 21st Century Learning, P21 Partnership for 21st Century Learning. 2015, p. 9.
[2]. Mobile Phone Penetration in Indonesia Triples in Five Years,Nielsen, 2011. [Online]. Available: https://www.nielsen.com/us/en/insights/news/2011/mobile-phone-penetration-in-indonesia-triples-in-five-years.html. [Accessed: 10-Sep-2018].
[3]. R. R. Pate, Dasar-dasar Ilmiah Kepelatihan (Semarang: IKIP Semarang Press, 1993).
[4]. J. M. Donelan, Q. Li, V. Naing, J. A. Hoffer, D. J. Weber, and A. D. Kuo, Biomechanical energy harvesting: generating electricity during walking with minimal user effort., Science, vol. 319, no. 5864, Feb. 2008, 807–10.
[5]. Y.-M. Choi, M. Lee, Y. Jeon, Y.-M. Choi, M. G. Lee, and Y. Jeon, Wearable Biomechanical Energy Harvesting Technologies, Energies, vol. 10, no. 10, pp., Sep. 2017, 14–83.
[6]. E. Schertzer and R. Riemer, "Harvesting biomechanical energy or carrying batteries? An evaluation method based on a comparison of metabolic power," J. Neuroeng. Rehabil., vol. 12, no. 1, p. 30, Dec. 2015.
[7]. A. D. Putri, R. T. Wahyuni, , Pemanfaatan Energi Kayuhan Sepeda untuk Pengisian Baterai Hand, P. Studi, T. Elektronika, and P. C. Riau, Universitas Kristen Satya Wacana, 2014.
[8]. W. Sunarlik, Prinsip Kerja Generator Sinkron (Buletin Daha, vol. 47, Kediri: Universitas Pawyatan Daha Kediri, 2011).

Minh-Huan Vo "Flexible Color Controller In Visible Light Communication System "American Journal of Engineering Research (AJER), vol. 7, no. 10, 2018, pp. 01-04