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The Influence of Livewire Application Utilization on Vocational School Students' Understanding and Psychomotor on Dynamic Electricity Topic

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Abstract

The aim of this research was to know the influence of the use of Livewire learning media and psychomotor for Light Vehicle Engineering Students on Dynamic Electricity Topic. This research used two group pretest-posttest method in which the object of the research divided into experimental group and control group consist of two different schools with the same major. An n*N-gain* analysis was used to calculate students' understanding on dynamic electricity. The results of the n-gain calculations showed two scores for experimental group and control group where the experimental group gained 0.51 and 0.34, meanwhile the control group gained 0.34 and 0.31. Nevertheless, both experimental groups as well as the control group considered as medium level. Based on the results of students' psychomotor in practicing (arranging) using livewire, the first experimental group gained a score of 74.16%, higher than the second experimental group that gained a total score of 73.10%, both in medium level. It can be concluded that N-gain score of the experimental group is higher than the control group. Along with that, the first experimental group had a higher score on psychomotor skills than the control group.

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INTRODUCTION

Dynamic Electricity subject is one of the basic competences on productive course for technical school students that works as a supporting material. Unfortunately, many students are facing difficulties in learning the subject. Misconceptions regarding dynamic electricity subject matter encompass 4 key aspects. These include: the passage of electric current through branches, series-parrallel circuits, passive components (such as lamps), and the resistance within closed circuits (Alhinduan, 2016). Experimental method on static electricity, dynamic electricity, and direct current (DC) electricity improves students' learning outcomes (Erly, 2020). Dynamic Electricity material has some huge aspects for the students. Research conducted by Rizaldi (2020) discovered about the presentation of materials analysis, facts, and procedures being the lowest in percentage, meanwhile the concept and principles dominated the percentage results. Another research conducted by Zumro'atun (2018) about prior identification of self-efficacy profile, physics learning outcomes, and learning model, acquired high self-efficacy level, less learning outcomes, and inquiry learning models.

Using whiteboard as a media to draw the electrical circuit during the learning process led to students' lack understanding on the materials. The use of virtual lab on experimental group has a higher improvement than convensional method applied to control group (Athalillah, 2017). Another research conducted by Gummrowi (2015) acquired that the use of virtual laboratory indeed increased students' learning outcomes. Meanwhile, Ika (2018) found that computer-based applications increased students' understanding of the concept of the material. Upgraded versions of learning media with attractive and visualized features can build up students' learning motivation in order that the students can easily gain more knowledge (Janzuli, 2015). Hence, to get a better understanding of this material, students used interactive learning in the classroom. The characteristic of electricity is abstract existing but not having a physical existence that can be seen by human eyes, therefore it needs medium to make it real. Interactive learning media developed by Janzuli (2015) aimed to produce more engaging learning media enrich with visual for electricity topic to increase students learning motivation. Suitable medium to change the concept of electricity to be concrete is urgently needed. One of the media than can be used is livewire. Livewire is an application that shows the electrical current, power, and resistance in an electrical circuit. Livewire is suitable for technical school students with their higher amounts of practical learning. This application is available on computer as well as mobile phone with easier access for students and teachers, both for individual practice and classroom learning. Urgent need of interactive learning media for students proven by research conducted by Kurniawan (2014) with positive response from the student.

Virtual Laboratory and Livewire application in learning process alleviate the students in the process of learning and understanding the material. This application allows the students to learn how to arrange electrical circuit without having to worry about the possibility of human error. This is a solution for students to get a better understanding of the material. Apart from that, in accordance with the research conducted by Zaus (2018) that showed that android-based topic learning for static and dynamic electricity topic is easier to perform by the students and teachers, its accessibility is a huge advantage for classroom learning. Interactive learning supported by Livewire indeed has a positive impact in improving students understanding towards the material. Much research on the impact of the utilization of Livewire as learning media for dynamic electricity subject matter supports this argument (Prasetyono, 2020). Additionally, the application of think-pair-share as one of the types of cooperative learning on students is also having positive impact in improving students learning outcomes on dynamic electricity topic (Kule, 2018). Another benefit in using Livewire application for classroom learning is that Livewire can identify errors in students' work. Problem-based learning model has significant difference in students' learning outcomes in dynamic electricity subject matter (Rahayu, 2016). Research conducted by Rupika (2018) found the impact of problem-based learning model in students' learning outcomes.

The use of learning media is one of the requirements in performing classroom learning. Media holds a huge aspect in determining the success of learning process. Athaliah et al (2017) conducted a study on the utilization of virtual media which improve students' understanding in the classroom with higher n-gain score gained by the experimental group than the control group. Meanwhile another research that applied experimental method provedto improve students' learning outcomes with the succession rate of 100% (Erly, 2020). The results showed that there are impacts of inquiry training learning model in students' learning outcomes in dynamic electricity subject matter (Siagian, 2016).

Livewire is a virtual electrical circuit application that can be used to arrange electrical circuit. The module developed by Cahyani et al (2018) is feasible to be utilized as a learning media. Another research in this matter is in form of student worksheet developed by Prasetyono et al (2020) with the purpose of improving students' critical thinking. Electrical circuit simulations provided by Livewire enlarge users' creative thinking, concepts, explication, and originality (Rahmi, 2020). Livewire

application has manyadvantages, including allows its users to build electrical circuit diagram, has symbols and codes based on ANSI (USA) and DIN (Europe) standard, comprehensive electrical components, easy to build, and so on. Developing web-based e-module will improve students' knowledge competencies achievement on dynamic and static electricity subject matter (Solihudin, 2018). Meanwhile, the application of electrical circuit and student worksheet improve students' cognitive score and characteristics (Setiawan, 2017).

Based on the explanation above, this research aims to find out the influence of the use of livewire learning media on conceptual understanding and psychomotor of students majoring in automotive light vehicle engineering on the subject of dynamic electricity. The benefit of this research is that it can improve students' understanding and psychomotor as a solution to overcome problems on the subject of dynamic electricity.

METHODS

This research used two-group pretest-posttest experimental design. The independent variable of this research was the use of Livewire as a learning media whilethe students as the dependent variable. This research usedrandom sampling in determining the sample from experimental group and control group (Mustari, 2015). In order to obtain more sample, two different technical schools were chosen to examine the validity of the test instrument, students that were previously received the materials being engaged in experimental class. Multiple-choices test was assessed through Microsoft Excel to obtain the validity, reliability, discrimination index, and tests' difficulty level. Finally, after being stated as valid, the instruments were ready to be used for pretest and posttest for experimental and control group. Experimental group usedLivewire as a learning media, meanwhile the control group used conventional learning media, in this case white board. This research used pre-experimental design where the dependent variable wasnot influenced by the independent variable (Rahmi, 2020).

There are two experimental groups from two different schools which hereinafter would be referred to as experimental group 1 and experimental group 2. Likewise with the control group that would be referred to as control group 1 and control group 2. N-gain calculation is needed to determine students' conceptual understanding score. The score obtained would be used to determine the experimental group and control group understanding of the dynamic electricity subject matter. Equation (1) provides the calculation of N-gain score (Rahmi, 2020).

$$g = \frac{S_f - S_i}{100 - S_i} \times 100\% \quad (1)$$

g : normalized gain
S_f : post-test score
S_i : pre-test score

Representation of N-gain results can be seen in table below.

Table 1. Normalized N-gain criteria

Standard gain score (g)	**Category**
$g > 0{,}7$	High
$0{,}3 \geq g \leq 0{,}7$	Medium
$g < 0{,}3$	Low

To determine the correlation of conceptual understanding with students' Livewire arranging skills in dynamic electricity topic can be seen in Equation (2) and *r* score interpretation below:

$$r = \frac{n\sum X_i Y_i - \sum X_i \sum Y_i}{\sqrt{\left(n\sum X_i^2 - (\sum X)^2\right)(n\sum Y_i^2\ (\sum Y)^2\ )}} \quad (2)$$

r : coefficient correlation
$\sum X$: the sum of X (understanding)
$\sum Y$: the sum of Y (psychomotor)
$\sum X \sum Y$: multiplication of X and Y

Table 2. *r* Score Interpretation

Coefficient Interval	**Value**
0.80 – 1.00	Very strong correlation
0.60 – 0.79	Strong correlation
0.40 – 0.59	Moderate correlation
0.20 – 0.39	Weak correlation
0.00 – 0.19	Very weak correlation

The calculation of students' psychomotor were conducted by using four aspects of rubric instruments. Feasibility test of the instruments was conducted by expert by using SOME aspects of rubric instruments provided. Meanwhile, the scoring was obtained by three different observers from three different field during Livewire practical class

The distribution of percentages for each aspect as well as calculation of students' psychomotor scores are shown in Table 3 and Equation (3) below.

Table 3. Calculation of Arranging Skills Score

	Work Process	**Result**	**Attitude**	**Time**	**Total**
Obtained Score	A	A	A	A	
Maximum Score	B	B	B	B	
Value	60	10	10	20	100
Total					

A = Obtained value, B = Maximum value

$$Total\ Score = \sum(\frac{obtained\ score}{maximum\ score} \times \text{Value}) \quad (3)$$

During the research, there were some findings that later can be used as additional data support in analyzing and matching the data based on the calculation results. Besides, these findings can be used as additional information thereout the numerical data.

RESULTS AND DISCUSSION

The process of obtaining the pretest and posttest data were conducted on random sampling of sample group. Experimental class as instruments validation were also randomly selected. Random selection was conducted to minimize the selection bias of eminent class as the experimental as well as control group. Multiple-choices instrument feasibility test was conducted on the experimental group that was provided with the electrical material prior to the data collection. Based on the results of the feasibility test, 8 out of 30 questions were infeasible. To conclude, the final questions that were being used in this research were 22 questions in total, referred to the distinguishing power and tests' difficult level.

The calculation of the validity, reliability, discrimination index, and tests' difficulty level were performed using Microsoft Excel. All components passing through the data input process according to data analysis. After being proven as feasible, the test instruments were ready to be utilized for experimental group and control group pretest and posttest. Data collection process in the experimental class was performed in computer lab as the Livewire application were already installed in each computer. Control group used white board in the classroom as the conventional learning media.

The sample of this research are Light Vehicle Engineering Students from two different technical school students. Another Major is excluded from this study because they did not meet the scope of this study. Students' knowledge ofcomputers for every experimental group were very much alike. This information needed to explain that this research did not have any correlation on students' computer skills as a medium in operating Livewire application. The results of the pretest and posttest on experimental group and control group can be seen in Figure 1.

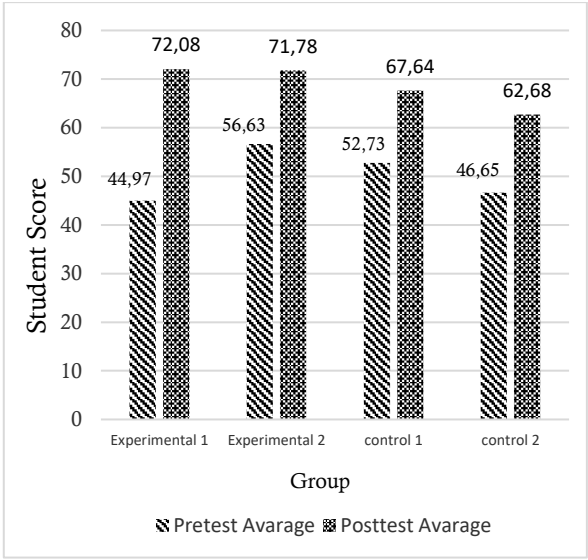

Figure 1. Pretest and Posttest Score

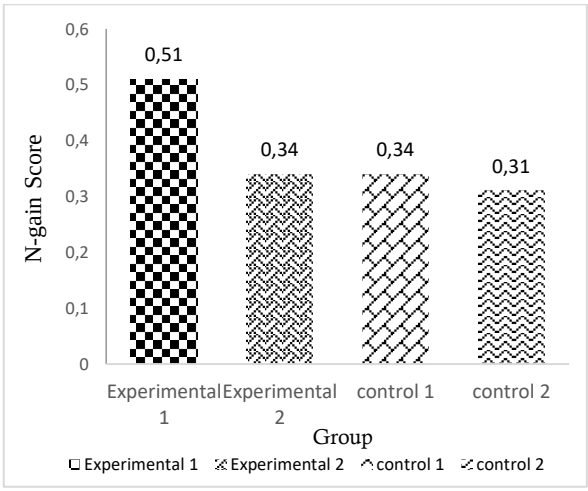

Figure 2. N-gain Score experiment and control

Based on the figure above, the pretest score of both experimental group and control group is low. Meanwhile, the posttest score for experimental group increased much higher than the control group. Both pretest and posttest scoring were performed in the same day, began with the pretest,

followed by the learning process, then finished with a posttest. The scoring aligned with the class schedule of each school in order to encure consistency.

The analysis of pretest and posttest data were perfomed to obtain N-gain score. The calculation of N-gain score was using Formula (1). The result of the calculation is shown on Figure 2 below.

The result of N-gain calculation showed that the control group 2 possessed the lowest score among all groups and experimental group 2 gained highest score, meanwhile the experimental and control group 1 possessed moderate score. All group were being categorized as in medium level. In conclusion, there is no differences in term of level of N-gain for every experimental and control group. Experimental group that was using virtual learning media possessed higher N-gain score than the control group that was using conventional method (Athaillah, 2017). This research acquired higher N-gain average score for experimental group than control group. This research was verified to match the results of previous studies.

Psychomotor aspects aredivided into 4 namely work process, result, attitude, and time. Percentages weighting for each aspect scored in order are 60%, 10%, 10%, and 20%. Students' psychomotor data analysis during Livewire practical learning to arrange electrical circuit is shown in Figure 3.

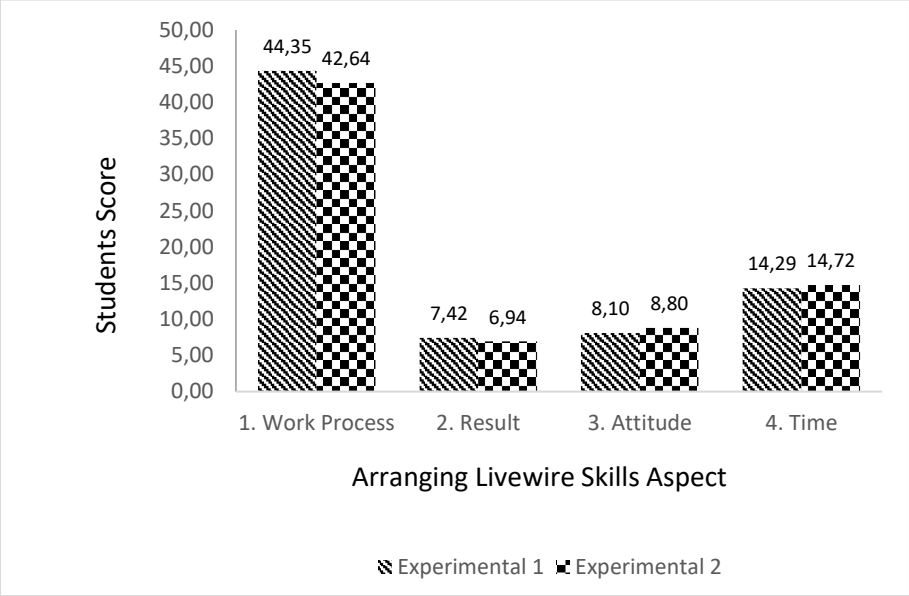

Figure 3. Students Psychomotor Score in Arranging Livewire Circuit

Psychomotor data were obtained in between the pretest and posttest. Three different observer perfomed the scoring before analyzing the results using average calculation for every aspect. Abidin et al (2015) discovered that students' understanding of the utilization of Livewire were in average score of 73.38% and 77.67%, meanwhile the average score of affective domains were in average score of 76.51% and 79.11%. Students psychomotor score in this research was verified to match the results of previous studies.

The process of obtaining and analyzing the data of the two groups from each school required much time. There are some findings that were not related to the statistical data of this research, namely time allocation for each group was minimum of 4 hours, divided into pretest, brief introduction and explanation of Livewire, practical learning, and posttest. The number of computers provided by the school helped the data obtaining process in terms of time efficiency. Another finding in this research was students' skill in operating computer. Moreover, students' skills in arranging electrical circuit using Livewire was below the average. This is one of the factors that caused the students' retardment despite of being given much time to finish their work.

CONCLUSION

This research found that students' understanding of related subject matter using Livewire application as a learning media in the experimental group gained higher N-gain average score than control group. Both groups also experienced increasing pretest and posttest score, so N-gain score were pretty much the same. N-gain calculation results showed that there are indeed impacts of Livewire application as learning media in students' learning outcomes in dynamic electricity subject matter. Moreover, the results of students' psychomotor skills in arranging electrical circuit using Livewire was higher on the experimental side,

especially experimental group 1 rather than experimental group 2, in medium level. Findings of this research are expected to be one of the evaluation materials for dynamic electricity subject matter using Livewire application as learning media in the future.

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