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ANALYSIS OF STUDENTS' LEARNING MOTIVATION USING A VIRTUAL LABORATORY DURING COVID-19 PANDEMIC ON HOOKE'S LAW

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Abstract

Since the spread of the COVID-19 outbreak, the world of education in Indonesia has faced difficult situation. Namely, it is mandatory to carry out online learning to reduce the impact of the spread of the COVID-19 virus. However, with the implementation of online learning, there is a decrease in student learning motivation so that an alternative is needed to generate student learning motivation, by using a virtual laboratory as a supporting medium. This research uses quantitative research with an accidental sampling method, with a population of science highschool from XI and XII grade students who are conducting online learning. The data analysis method uses non-parametric Mann-Whitney U statistics and measures student learning outcomes in Hooke's Law with a virtual laboratory. The results showed that by using a virtual laboratory students' learning motivation increased from online learning in general, because the p-value is 0.000 which $p < 0.05$ means there is a significance change. Students wih higher learning motivation score better than students with lower motivation. With the average score in a row from medium, high, and very high motivation is 39.29; 43.70; 44.00 from the maximum score 100.

Keywords: Learning Motivation, Virtual Laboratory, Online Learning.

Abstrak

Sejak merebaknya wabah COVID-19, dunia pendidikan di Indonesia menghadapi situasi sulit. Yakni, wajib melaksanakan pembelajaran online untuk mengurangi dampak penyebaran virus COVID-19. Namun dengan diterapkannya pembelajaran online, terjadi penurunan motivasi belajar siswa sehingga diperlukan suatu alternatif untuk membangkitkan motivasi belajar siswa, yaitu dengan menggunakan laboratorium virtual sebagai media pendukung. Penelitian ini menggunakan penelitian kuantitatif dengan metode *accidental sampling*, dengan populasi siswa SMA IPA kelas XI dan XII yang sedang melaksanakan pembelajaran online. Metode analisis data menggunakan statistik *Mann-Whitney U* non parametrik dan mengukur hasil belajar siswa pada Hukum Hooke dengan laboratorium virtual. Hasil penelitian menunjukkan bahwa dengan menggunakan laboratorium virtual motivasi belajar siswa meningkat dari pembelajaran daring pada umumnya, karena p-value 0,000 yang $p < 0,05$ artinya ada perubahan yang signifikan. Siswa dengan motivasi belajar yang lebih tinggi skor lebih baik daripada siswa dengan motivasi yang lebih rendah. Dengan skor rata-rata berturut-turut dari motivasi sedang, tinggi, dan sangat tinggi adalah 39,29; 43,70; 44.00 dari nilai maksimal 100.

Kata kunci: Motivasi Belajar, Laboratorium Virtual, Pembelajaran Daring

INTRODUCTION

Every Indonesian citizen has the right to get an education. That is the sound of Article 31 paragraph (1) of the 1945 Constitution. Based on this law, it is clear that all levels of society can obtain an education. Make Indonesia a better country.

However, it commonly known that there are problems occured in education system. Currently, the world of education in Indonesia faces a challenge, namely the global pandemic of the COVID-19 virus, which is spreading more widely. So, to reduce the spread of the virus, Circular No. 4 of 2020 concerning the Implementation of Educational Policies in the space of the virus requires public cooperation to reduce the spread of the virus through social distancing. So that all activities that should be carried out outside the home and are required to meet face-to-face, people are now advised to carry out activities from home. This does not have an impact on activities in learning activities at school. With this policy, teaching and learning activities must be carried out boldly.

With these circumstances where previously teachers and students met face to face in the classroom and could interact directly at this time, teachers and students are

required to interact in a virtual classroom. Where the space and time for teachers and students to interact is more limited than interacting directly. So, the teachers must be creative in creating a learning atmosphere that can be accepted by students and achieve the desired target. So that to achieve learning objectives, especially in this case, physics subjects become more complex due to obstacles such as limited internet quotas, offline teaching and learning habits, students' misunderstanding due to lack of interaction, parental involvement slows down teaching and learning, etc. (Purwanto, 2020). Thus, it is easier for students to feel stressed because they feel bored and can impact student learning motivation. Suppose students' learning motivation decreases due to boredom or stress due to online learning. It will impact students because, with good student motivation, students in achieving learning goals will achieve success (Emda, 2018).

Therefore, the Minister of Education and Culture through Kepmendikbud number 719/P/2020 simplifies the curriculum in academic units from elementary to high school during the COVID-19 pandemic. The simplification of the curriculum issued by the Minister of Education and Culture was to reduce the Basic Competencies to be much simpler to reduce the burden of student learning and make it easier for teachers to teach and give efficient learning activities. Although the Basic Competencies have been simplified, the goal of achieving KI-3 for knowledge and KI-4 for skills must also be performed.

By simplifying the curriculum, it does not mean that it is challenging to carry out teaching and learning activities until there, especially the subject teachers. Moreover, physics subjects, which require more interaction so that students can understand physics without misinformation (Giancoli, 2005). In addition, according to Giancoli (2005), understanding physics also requires observation and experience based on reality where students can feel connected. With this laboratory, it is hoped that it can foster students' motivation and critical thinking behavior. Critical thinking provides students with the basic intellectual skills and skills they need to think about the material in any class, subject, or discipline (Elder, 2020). With laboratory, student able to gather relevant information related to the study from the surrounding daily life environment (Arifin, 2017).

However, with the Covid-19 pandemic, laboratory learning will not be carried out conventionally, so teachers need to find other ways to carry out laboratory learning activities using virtual laboratories.

Based on the description above, the researcher assumes that it is necessary to identify how much influence the use of virtual laboratories in online learning during the COVID-19 pandemic supports student learning on student motivation in Hooke's Law. It is expected that it can help high school teachers who teach physics subjects to understand how students' learning motivation is by using virtual laboratories as learning support during the COVID-19 pandemic. And help students understand the subject by using media to help obtaining information that sometimes difficult to be presented in the student's (Madeali, 2018). Because students find out that physics concept is abstract especially when they receive new material, this thing can't be neglected and need teacher guidance while learning physics (Prahani, 2017). This study aimed to examine students' learning motivation by using a virtual laboratory as a support, by taking physics subjects with Hooke's law. And to measure how is the outcomes from the students when using virtual laboratory.

RESEARCH METHOD

This study used quantitative research with Mann-Whitney U analysis because this study did not meet the homogeneity test. This analysis is a parametric analysis used to test whether there is a difference between the response variables caused by the independent variable (Suseno: 2012). By comparing it with the research that has been done by Cahyani, et al (2020). Where students' learning motivation decreases in online learning COVID-19.

The population in this study were science high school students who had received Hooke's Law material and were conducting online learning activities. The sampling technique used by the researcher is accidental sampling, which is a sampling technique based on a chance meeting with the researcher and can be used as a sample and is suitable as a data source (Sugiyono, 2009:85).

To assess students' learning motivation by learning using a virtual laboratory, the author will start with the method that has been developed by Yuniarto (2017) to measure students' learning motivation. Questionnare that used to measure students learning motivation is SMTSL, which stands for Student Motivation Towards Science Learning. By observing various aspects:

1) Self-efficacy. Students' confidence in their abilities.
2) Active learning strategies. Student participation in the learning methods used.
3) Science learning values. The benefits of studying science.
4) Performance goals. Student goals in learning.
5) Achievement goals. Student satisfaction in the ability to achieve competence.
6) Learning environment stimulation. The influence of the learning environment.

By using six points above with several adjustments, researcher able to obseve students' learning motivation using a virtual laboratory.

Previously, research on learning motivation in high school students had been carried out by Cahyani, et al (2020). That is to measure how much high school students' learning motivation during online learning of covid-19 is. However, the learning method used is still conventional, namely by using video conferencing and asynchronous classes such as Google Classroom as the primary learning media without any other supporting media. Thus, researchers can use the results obtained from the study to determine student learning outcomes when using a virtual laboratory as a support for learning media. The researchers translated the existing and developed questionnaires and then adjusted them to evaluate students' learning motivation when using the laboratory to support physics learning.

The research conducted with the sample from XI, XII grader science who had studied physics subject Hooke's law theory. Questionnaires were distributed using Google form media which were distributed to high school students. The learning motivation questionnaire with a virtual laboratory used five Likert scales as an assessment with the choices of strongly disagree, disagree, don't know, agree, and strongly agree, and each criterion based on the Likert scale value of 1, 2, 3, 4, 5 consecutively.

In addition, Hooke's Law quiz, which contains four problems using a virtual laboratory as a solution, is also used to measure student learning outcomes using a virtual laboratory. The maximum score obtained from the quiz is 100, with a different weight for each question. So that it can find out student learning outcomes when using a virtual laboratory. The virtual laboratory operated by the researchers is a PhET simulation developed by the University of Colorado which can be accessed at https://phet.colorado.edu.

The quiz is given instructions for filling out and instructions for accessing the appropriate experiment. In this quiz, the experiment is an experiment with the title masses and spring.

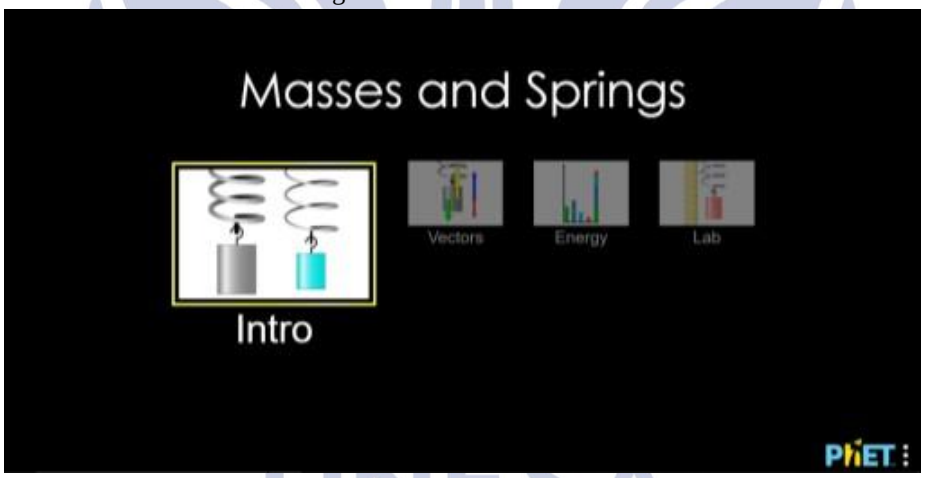

Figure 1. Masses and spring experiment home view

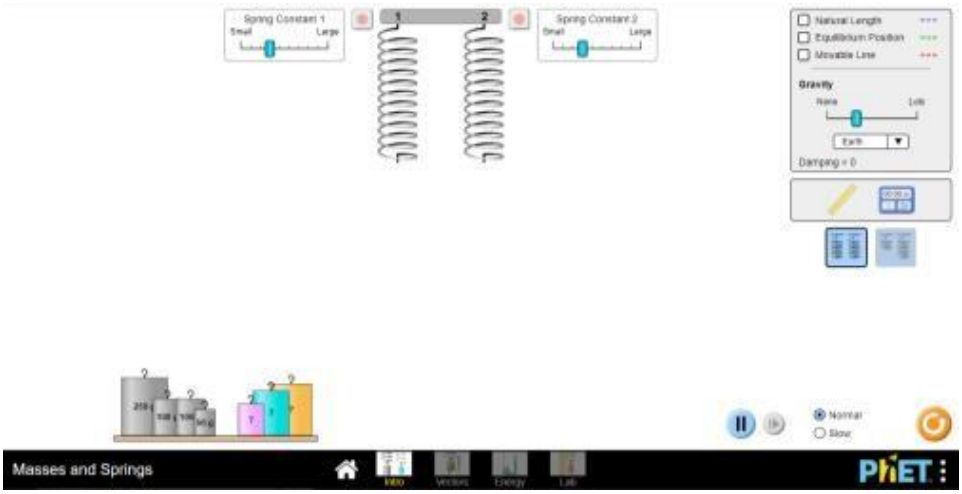

Figure 2. View from masses and spring experiment

Questionnaires and Hooke's law quiz were distributed through the online media google form simultaneously for two weeks, from April 12, 2021 to April 26, 2021. It is hoped that the distribution of questionnaires and Hooke's law quiz can be carried out evenly aimed at high school students online.

After two weeks of distributing the questionnaires, 93 respondents came from high schools in Surabaya. This is where the respondents consisted of high school students grade 11 as many as 30 respondents and grade 12 as many as 63 respondents.

RESULT AND DISCUSSION

To perform data analysis, it is necessary to categorize the subject first. The purpose of subject categorization is to place individuals into groups whose positions are tiered according to the series on each variable (Cahyani, et al 2020:135). Based on the normal curve, the subject category can be divided into three or five categorizations based onthe standard deviation of the normal curve. In this study, researchers used five subject categorizations, namely very low, low, medium, high, and very high. The categorization formula used is as follows:

Table 1. Subject Categorization Formula

Category	Formula
Very low	$X \leq \bar{X} - 1.5\sigma$
Low	$\bar{X} - 1{,}5\sigma < X \leq \bar{X} - 0.5\sigma$
Medium	$\bar{X} - 0{,}5\sigma < X \leq \bar{X} + 0.5\sigma$
High	$\bar{X} + 0.5\sigma < X \leq \bar{X} + 1.5\sigma$
Very High	$\bar{X} + 1.5\sigma < X$

Source: Azwar (2012).

Description:
X = Total value
$\bar{X}$ = Mean
σ = Standard deviation.

So, by adding up the total value of the questionnaires given to the respondents, the categorization of learning motivation using a virtual laboratory is obtained as follows:

Table 1. Categorization of Motivational Values Using Virtual Laboratory

Category	Formula	Amount	Presentation (%)
Very Low	X ≤ 70	0	0.0
Low	70 < X ≤ 93	0	0.0
Medium	93 < X ≤ 117	6	6.5
High	117 < X ≤ 140	74	79.6
Very High	140 < X	13	14.0
Total		93	100.0

From Table 2, there are categories of subjects for learning to use a virtual laboratory, starting from very low, low, medium, high, and very high. However, as shown in the table, no students have very low and low learning motivation. A total of 6 out of 93 subjects (6.5%) students have the motivation to learn in the medium category when using a virtual laboratory. Then as many as 74 of the 93 subjects (79.6%) students have high motivation to use a virtual laboratory which is the majority of the respondents. Meanwhile, 13 of the 93 subjects (14%) were students who entered the high category when learning to use a virtual laboratory.

Because this study has non- homogeneous data, the researcher uses a non-parametric statistical analysis of Mann-Whitney U. That is to test whether there are differences in the independent variables and response variables. Researchers used research that had been conducted by Cahyani, et al (2020) to find out the online learning motivation of high school students as a reference. To perform data analysis, researchers used SPSS to conduct the Mann-Whitney U analysis.

SPSS is the application used to perform advanced statistical analysis, analyze data with machine learning algorithms (Zein, et al, 2019). The results of the analysis are:

Table 3 Statistic test using *Mann- Whitney U*

Variable	*Mann-Whitney U*	*Asymp. Sig* (p)	Result
Motivasi belajar dengan Lab. Virtual	4960.000	.000	**p** < 0.05

Based on the table presented above, it is found that the Mann-Whitney U value is 4960,000 and has a significance of 0.000. If the p-value < 0.500 indicates there is a significant difference between the two variables. This means that there is a substantial difference in students' learning motivation compared to research done by Cahyani, et al (2020) which doesn't use virtual laboratory or use any kind of media for learning. This shows that students who use virtual laboratories as media to support learning during covid-19 online learning have higher learning motivation than students who do not use them.

The student learning outcomes on Hooke's Law material using a virtual laboratory are based on the amount of learning motivation as follows:

Table 4 The score of student learning outcomes on Hooke's Law using a virtual laboratory

Student learning motivation	Average score
Medium	39.29
High	43.70
Very High	44.00

As has been presented in table 3, namely the average value of the Hooke's Law quiz to determine student learning outcomes when using a virtual laboratory. It can be seen that students with moderate learning motivation using virtual laboratories have an average value of 6 respondents of 39.29. Students with moderate learning motivation have an average value of 43.70 from 74 respondents. And students with high learning motivation have an average of 44.00 of 13 respondents.

This indicates that students with higher learning motivation when using virtual laboratories have higher learning outcomes. However, from each category of learning motivation, be it from the medium, high, and very high categories, there is a very low value, namely a value of 0 from the medium and high category and a value of 8 from the very high category. Based on the responses received in Hooke's Law quiz, the respondent with the lowest score noted that the student was still not familiar with the use of virtual laboratories. So that students are confused when they will use it as a media to support learning. But on the other hand, students who get the highest high score, namely 80 from the category of very high learning motivation based on the responses from Hooke's Law quiz, can use virtual laboratory media to the fullest. When the researcher personally asked the student who got the highest score, the student admitted that he had at least once used a virtual laboratory or other similar media as learning support media.

Based on the data described above, students with higher motivation to learn using virtual laboratories tend to have higher learning outcomes. According to Kompri (2016: 233), this is in line where learning motivation directly directs students towards practical learning activities but will get positive considerations in student learning activities. According to research conducted by Dewa, et al (2020), Syaifulloh (2014), which states that online learning with the help of a virtual laboratory provides convenience to students to improve student learning outcomes. Also, learning with laboratory also developed skills that related to the experimental procedure which should be separated from interpreting data and making a report (Suprapto, 2017).

Learning motivation involves in the student learning process. Learning is essentially a process, namely regulating, organizing the environment around students to grow, and encouraging students to carry out the learning process. Learning is also said to provide guidance or assistance for students in the learning process (Dasopang, 2017).

The definition of learning is where a person can make lasting changes in behavior or in the capacity to behave in specific ways, resulting from practice or other forms of experience (Schunk, 2012). Students' learning motivation can grow from themselves or intrinsic factors and from outside the student's environment or extrinsic factors. Intrinsic factors are factors that arise from the students themselves. For example, it can be in the form of self- confidence or self-awareness to learn and come from yourself without any influence from others. At the same time, extrinsic factors can come from the support of the school environment, where the school environment is an essential institution after school (Musab, 2019).

The data shows that using a virtual laboratory as a media to support learning in the COVID-19 period can increase student learning motivation and improve student learning outcomes. By triggering student learning motivation from extrinsic factors, it can increase student learning motivation using virtual laboratories.

Increased student motivation also shows better learning outcomes compared to students with low learning motivation. It is hoped that all teachers and lecturers, who are not closed to physics subjects, can use more interactive learning support media to increase student learning motivation in the current COVID-19 pandemic situation.

CONCLUSION

During the COVID-19 pandemic, teachers and students are required to conduct online teaching and learning activities. This causes teachers and students not to interact when carrying out teaching and learning activities, which also decreases students' learning motivation. However, by using a virtual laboratory as a media to support learning, students have higher learning motivation, impacting student learning outcomes during Covid-19 online learning. Because the use of virtual laboratories has a positive effect on students in understanding a concept (Gunawan, 2018). Also, Virtual lab learning is more efficient, whether during a pandemic or not, because learning with a virtual lab is carried out faster than learning with a conventional lab (Syaifulloh, 2014). Not only student, using any kind laboratory learning is valid so that it is feasible to improve the process skills and creativity of physics teacher candidates (Dwikoranto, 2018).

REFERENCES

Azwar, S. 2012. *Metode Penelitian*. Yogyakarta: Pustaka Belajar

Arifin, L., & Sunarti, T. (2017). THE IMPROVEMENT OF STUDENTS'SCIENTIFIC LITERACY THROUGH GUIDED INQUIRY LEARNING MODEL ON FLUID DYNAMICS TOPIC. Jurnal Penelitian Fisika dan Aplikasinya (JPFA), 7(2), 68-78.

Cahyani, Listiana, Larasati. (2020). Motivasi Belajar Siswa SMA pada Pembelajaran Daring di Masa Pandemi Covid-19. *IQ (Ilmu Al-qur'an): Jurnal Pendidikan Islam*, 3(1), 123-140.

Dewa, E., Mukin, M. U. J., & Pandango, O. (2020). Pengaruh pembelajaran daring berbantuan laboratorium virtual terhadap minat dan hasil belajar kognitif fisika. *Jurnal Riset Teknologi dan Inovasi Pendidikan (JARTIKA)*, *3*(2), 351-359.

Dwikoranto, D., Setiani, R., Madlazim, M., & Erman, E. (2018, December). Validity of Project Based Laboratory Learning: An Innovative Physics Laboratory Learning to prepare Sciences Process Skills and Creativity of Physics Teacher Candidate. In International Conference on Science and Technology (ICST 2018) (pp. 912-917). Atlantis Press.

Elder, L., & Paul, R. (2020). *Critical thinking: Learn the tools the best thinkers use*. Foundation for Critical Thinking.

Emda, A. (2017). Laboratorium Sebagai Sarana Pembelajaran kimia dalam meningkatkan pengetahuan dan ketrampilan kerja ilmiah. *Lantanida journal*, *5*(1), 83-92.

Emda. (2017). Kedudukan Motivasi Belajar Siswa Dalam Pembelajaran. *Lantanida Journal*, 5(2), 93-196.

Giancoli, D. C. (2005). Physics: Principles with applications. (6th ed.) Upper Saddle River, NJ: Prentice-Hall.

Gunawan, G., Nisrina, N., Suranti, N. M. Y., Herayanti, L., & Rahmatiah, R. (2018, November). Virtual laboratory to improve students' conceptual understanding in physics learning. In *Journal of Physics: Conference Series* (Vol. 1108, No. 1, p. 012049). IOP Publishing.

Kementrian Pendidikan dan Kebudayaan. (2020). *Pedoman Pelaksanaan Kurikulum Pada Satuan Pendidikan Dalam Kondisi Khusus* (Kepmendikbud No. 719/P/2020). Jakarta Pusat.

Madeali, H., & Prahani, B. K. (2018, March). Development of multimedia learning based inquiry on vibration and wave material. In Journal of Physics: Conference Series (Vol. 997, No. 1, p. 012029). IOP Publishing.

Miftahun Ni'mah Suseno. Statistika: Teori dan Aplikasi Untuk Penelitian Ilmu Sosial dan Humaniora. 2012. Yogyakarta: Ash- Shaff, t.t.

Musab, I., & Witri, G. (2019). Faktor Ekstrinsik yang Mempengaruhi Motivasi Belajar Siswa Kelas IV Sekolah Dasar Se-Gugus 2 Kecamatan Sail Pekanbaru. *Primary: Jurnal Pendidikan Guru Sekolah Dasar*, *8*(1), 7-12.

Pane, A., & Dasopang, M. D. (2017). Belajar Dan Pembelajaran Aprida Pane Muhammad Darwis Dasopang. *Jurnal Kajian Ilmu-Ilmu Keislaman*, *3*(2), 333–352.

Prahani, B. K., Soegimin, W. W., & Yuanita, L. (2017). Pengembangan Perangkat Pembelajaran Fisika Model Inkuiri Terbimbing untuk Melatihkan Kemampuan Multi Representasi Siswa SMA. JPPS (Jurnal Penelitian Pendidikan Sains), 4(2), 503-517.

Purwanto et al., (2020). Studi Eksploratif Dampak Pandemi COVID-19 Terhadap Proses Pembelajaran Online di Sekolah Dasar. *EduPsyCouns Journal*, 2(1), 1-12.

Schunk, D. H. (2012). *Learning Theories: An Educational Perspective*. Pearson (6th Editio). Boston: Pearson

Sugiyono, 2009, *Metode PenelitianKuantitatif, Kualitatif dan R&D*, Bandung: Alfabeta.

Suprapto, N., Chang, T. S., & Ku, C. H. (2017). Conception of learning physics and self-efficacy among Indonesian university students. Journal of Baltic Science Education, 16(1), 7

Syaifulloh, R. B. (2014). Penerapan pembelajaran dengan model guided discovery dengan lab virtual PhET untuk meningkatkan hasil belajar siswa kelas XI di SMAN 1 Tuban pada pokok bahasan teori kinetik gas. *Inovasi Pendidikan Fisika*, *3*(2).

Yuniarto. (2017). Pengembangan Instrumen Penilaian Motivasi Belajar Mahasiswa Pendidikan Matematika. *LIKHITAPRAJNA Jurnal Ilmiah*, 19(2), 1-8.

Zein, S. Z., Yasyifa, L. Y., Ghozi, R. G., Harahap, E., Badruzzaman, F. H., & Darmawan, D. (2019). Pengolahan dan Analisis Data Kuantitatif Menggunakan Aplikasi SPSS. *Teknologi Pembelajaran*, *4*(2).