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Effectiveness of Online Learning Assisted by *Olabs* Virtual Laboratorium in Improving Students' Science Process Skills

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Abstract

Most learners are less able to understand lessons in distance learning, so it is very necessary for teacher guidance to follow learning through observation, experimenting, and active experiments. The purpose of this study is to analyze the effectiveness of online learning assisted by virtual laboratories in improving the science process skills of SMKN Jateng di Semarang students. The research method uses the *pretest-postest control group design* with analysis of N-gain parametric statistical test data, as well as *the t-test sample paired test*. Samples in this study were obtained by *purposive random sampling* techniques from class X SMK N Jateng di Semarang which amounted to 120 students. The results of the analysis of the skills of the experimental grade acid-based material science process obtained an average *pretest* result of 57.2 and an average *post-test* result of 69.6 so it has a value of g = 0.43 with a medium category. In the control class analysis, *the pretest* average result was 47.4 and the average *post-test* result was 54.36 so it had a value of g = 0.27 with a low category. The results of the T-test in the experimental class were obtained that there was a significant influence with a sig. 0.000 < 0.05 so H_o was rejected and H_a was accepted, so there was a difference in the average skill of the science process before and after learning. online assisted virtual laboratories olabs.

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INTRODUCTION

The outbreak of the pandemic caused by the Corona virus in Indonesia, caused the government to do many ways to prevent its spread. As an effort to prevent the spread of Covid-19, WHO recommends temporarily stopping activities that have the potential to cause crowds (Sembiring & Arisandy, 2016). For this reason, conventional learning that gathers many learners in one room needs to be reviewed (Moore *et al.* , 2011). Learning must be carried out with scenarios that are able to minimize physical contact between students, or between students and teachers. Learner-oriented learning can be done by building a learning system that allows learners to have the ability to learn more interestingly, interactively, and varied (Bali & Liu, 2018). Learners must be able to have competencies that are useful for their future. Along with the development of technology and its supporting infrastructure, efforts to improve the quality of learning can be done through the use of these technologies in a system known *as online learning*. One form of alternative learning that can be carried out during the Covid-19 emergency is online learning (Bahasoan et al., 2020; Deli & Allo, 2020; Hasbullah, 2015).

At the beginning of online learning there are learning problems that cause *learning loss*, this is in accordance with the case studies that have been conducted (Migue, 2021; Syahfitri et al., 2019; Wahyu Prihmardoyo, Sajidan, 2017), where the cause of *learning loss* is one of the obstacles in terms of infrastructure. For this reason, the use of technology media is a solution to the means of handling learning problems online. According to (Adnan & Anwar, 2020; Dhawan, 2020; Hoi *et al.* , 2021; Rodrigues, 2015) teknology acts as a medium in online learning interaction, technology as a facility and delivery of learning materials. One of the uses of technology with the use of virtual laboratories as a learning aid medium (Epinur & Yusnidur, 2015). Virtual laboratories are defined as interactive environments, as a means of creating and conducting simulation experiments, consisting of dependent domains of simulation programs, experimental units called objects that include data files, tools that operate on objects, and reference books (Gunawan et al., 2019; Luki & Kustijono, 2017; Siswanto et al., 2018).

In the learning process, important science process skills are raised and developed because with that students not only learn about what already exists but also learn about how to get new knowledge, therefore with the skills of the science process, students are asked to be more active and creative when finding problems must be solved and associate lessons with everything that occurs in their (Jaya, 2013; Maulina & Kustijono, 2017; Trisnawati & Yetri, 2019). Science process skills can be trained to students by gaining hands-on experience guided by teachers during the learning process (Hanik et al., 2019); Indiharti & Ariyatun, 2022). The fact is that currently science process skills cannot be trained with hands-on experience because learning is done online. Student SPS indicators during online learning have not been achieved as a whole as a whole as a maximum because it is constrained by the absence of practicum and lack of guidance from teachers, and when practicum is carried out individually by students, the tools and materials used are still minimal and students use simple tools and materials at home (Rahayu et al., 2013; Sri Asmorowati et al., 2021).

Based on the results of observations made by researchers in the 2020/2021 school year at SMKN Jateng di Semarang, students' science process skills in chemical practicum are still low. Observations were also made on the practicum reports of learners. The results obtained are the student's practicum report is not in accordance with scientific rules. The practicum report created contains only objectives, tools and materials, working steps, observational data and cnclusions. Learners are not taught about the types of research variables nor how to formulate hypotheses so that learners cannot determine research variables and formulate hypotheses. In addition to not determining research variables and formulating hypotheses, discussions about practicum data have largely not been written in practicum reports. Based on the development of this technology, many

researchers are trying to prove the effectiveness of online learning with virtual laboratories, especially during the pandemic. Previous research tested the effectiveness of the laboratory against a wide variety of research variable results, such as learning outcomes, interests and learning motivations. A lot of research on this subject is the basis for this research. This research is an experimental study that aims to prove the effectiveness on online learning assisted by virtual laboratories *olabs* in developing students' science process skills on alkaline acid matter.

METODS

This research is an experimental study with the design of *pretest-posttest control group design*. Experimental research is research conducted to test the impact of a *treatment* (intervention) on the results of research controlled by other factors that may influence these results. Experimental methods are carried out with the intention to see the consequences of a treatment. Samples in this study were obtained by *purposive random sampling* techniques from class X SMK N Jateng di Semarang which amounted to 120 students. The science process skill data is analyzed using the analysis of *N-gain* parametric statistical test data, as well as *the paierd test of the t-test sample*. Before the data is analyzed, a prerequisite test is carried out in the form of normality and homogeneity tests.

Hypothesis tests are used to determine whether or not there are differences in students' science process skills before and after the application of online learning assisted by virtual laboratories. To find out the average comparison of two variabels in one group using *the paired test of t-test samples.* This analysis is useful for testing two related/correlated samples or two paired samples (*pretest* and *postest*) in the experimental class and kontrol class. Requirements for pairing *samples of t-test* SPSS for Windows version 24.00 data are tested using normality and homogeneity tests to determine normal and homogeneous distribution data. If one of the data is not distributed normally and is not homogeneous then the *t-test paired test* is replaced by using the *nonparametric Two Related Sample Test* SPSS for windows 24.00 or also called *wilcoxon* test. The criteria in this study if the results of the hypothesis test sig value (2-tailed) are smaller than the alpha value/level of test significance 0.05 then Ha is accepted and Ho is rejected.

RESULT AND DISCUSSION

This research is intended to analyze the effectiveness of online learning assisted by virtual laboratories olabs effective in improving the skills of science process (SPS) students of SMKN Jateng. SPS indicators assessed are observing, identifying variables, hypothesizing, applying concepts, initiating, and communicating. The skills of the science process in this study were analyzed using observation sheet instruments.

Prerequisite Test Analysis

Infrastructure testing is held to find out the data obtained is distributed normally and homogeneously. Normal distributed data is used hypothesis tests with parametric statistics.

Normality Test

The normality test in this study was the Kolmogorov-Smirnov test with a sig level of $\alpha = 0.05$ with the statistical application of SPSS 24.0. The results showed normal distributed data. The results of the post-test normality test of both classes can be seen in the sig value in Table 1.

Based on Table1 Normality test results with a significant level of 0.05. If the Sig > 0.05 then it can be concluded that the data is normal distributed. The analysis of the complete normality test can be seen in the Appendix.

Homogeneity Test

This normal or non-research distributed homogeneous data test is using a homogeneity of variances test with sig α = 0.05. The acceptance criteria are that if a Sig > 0.05 H1 is accepted then a homogeneous sample and if a Sig < 0.05, H0 is rejected then the sample is not homogeneous. The homogeneity results of both classes use homogeneity of variances tests as in Table 2.

Table 2. Homogeneity Test Results

Characteristic	Homogeneity Test Results	Result	Conclusion
Sig (2-Tailed)	0.872	Sig (2-tailed)> α	Homogeneous
α	0.05		

Thus, it can be concluded that $_{H1}$ received Sig > 0.05 means that the population has the same variance. Once it is known that the data comes from the same population. Then it can be continued by using parametric statistics, namely a two-Way Variance Analysis Test.

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Based on data that has been declared normal and homogeneous, so hypothesis testing uses a two-way variance analysis test in the SPSS 24.0 statistical application. This hypothesis test is used to check whether there is an influence of a treatment on learning outcomes reviewed from SPS. The hypotheses to be tested are as follows:

H_0: $\mu \leq \mu_0$ (No difference in SPS before and after online learning assisted by Virtual Olabs laboratory)

H_a: $\mu \geq \mu_0$ (There are differences in SPS before and after online learning assisted by Virtual Olabs laboratory)

Hypothesis testing using *the paired sample T-test* with the help of spss program version 24 with *output* results can be seen in Table 3.

Table 3. Paired Sample T-test Results

Group	Average Value	SD	Sig results. (2-tailed)	Influence
Experiment	69,6	6,2	0.000 < 0.05	Significant
Control	57, 2	4,8	0.337 < 0.05	Insignificant

Based on the data obtained from the results of the data analysis above, it shows that the average value of experimental class learning results is better than the control class, with a much different distribution of values. This is indicated by the magnitude of the standard deviation value (standard deviation), the more the standard deviation of the data is close to zero, the more uniform the distribution of the data is with the average value of the existing data. This means that the distribution of data obtained is getting better. Hypotheses regarding the influence of online learning assisted by virtual laboratories olabs on the increase in student SPS in Table 3. The results of the T-test in the experimental class were obtained that there was a significant influence with a sig. 0,000 <

0.05 so that Ho was rejected and Ha accepted, so there was a difference in the average SPS before and after assisted online learning virtual laboratory olabs.

The magnitude of the increase in student SPS in the class that applies the virtual laboratory olabs obtained from the calculation of the N-gain (g) formula, namely by comparing *pretest* and *postest scores*. In the analysis of the skills of the experimental grade acid-based material science process obtained an average *pretest* result of 57.2 and an average *posttest* result of 69.6 so that it has a value of g = 0.43 with a medium category. In the control class analysis, *the pretest* average result was 47.4 and the average *posttest* result was 54.36 so that it had a value of g = 0.27 with a low category. While the acquisition of the N-gain category for each group is summarized in Figure 1.

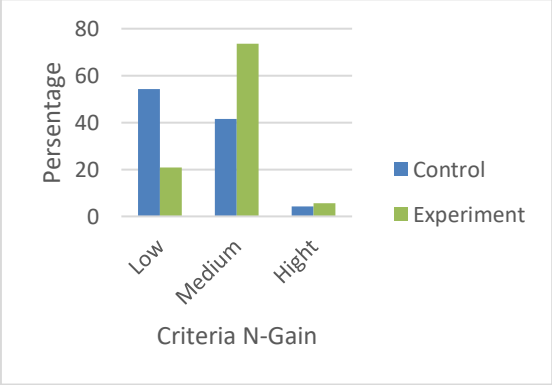

Figure 1. N-Gain SPS Analysis

Figure 4. 1 showed that in the experimental group there were 73.6% of learners who experienced moderate increases, 5.5% with high increases and 20.8% with low increases. While in the control class there were 54.2% with low increases, 41.6% with high proficiency and 4.2% with low proficiency in acid-base learning. Data from observation of science process skills is used to determine the influence of online learning assisted by virtual laboratories olabs on students' science process skills. The science process skills analysis used in research refers to six aspects of integrated science process skills that include observing, identifying variables, hypothesizing, applying concepts, inference and communicating. The average value of each aspect of the science process skills test is presented in Figure 2.

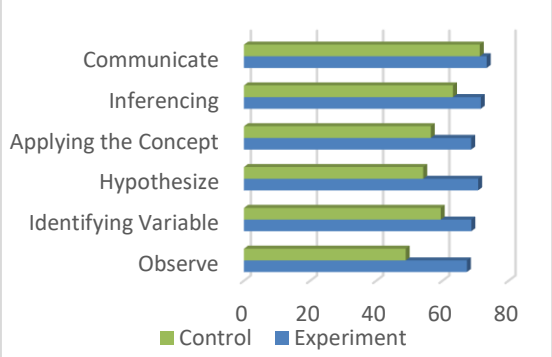

Figure 2. Science process skills Analysis of Each Indicator

The results of the analysis of students' science process skills showed that there were significant differences in the achievement of science process skills between the treatment groups using virtual laboratories when compared to the control group using conventional practicums. The results of

previous research are also known that learning with virtual laboratories can improve students' understanding and skills in science learning (Serevina & Kirana, 2021; Syafrina et al., 2018). These results are in line with the acquisition of observations of science process skills conducted during the research that is presented in Figure 3.

Figure 3. Science Process Skills Profile

Based on Table 3. it was obtained that students in the experiment class with SPS with better criteria were more than SPS with very good criteria, enough and not good so that overal the SPS profile in the exhibition class was in good category. While in the SPS control class with good criteria is much less when compared to the criteria well enough so that overal the SPS profile in the control class is in the category quite well. Based on the results of the analysis, it can be seen that the average value of the pretest is lower than the average value of the posttest. The N-Gain value obtained is 0.43 with the medium category and in the control class with n-gain 0.27 low category. This N-Gain value shows that there is an increase in material mastery in students after conducting learning activities using the virtual laboratory learning media olabs on the acid-base material developed. Increased mastery of the material is possible because more acidic-base lab virtual learning media gives students the opportunity to experience for themselves, follow a process, observe a particular object, state or process and draw conclusions.

The achievement of experimenting skills also showed a significant difference in results between the experimental class and the control class. The application of practicum instructions combined with virtual laboratory applications causes students to know the concept through the study of materials on practicum instructions and understand the basic principles of experiments or observations on actual conditions through virtual laboratories. The findings are in line with some of the results of previous research, namely the use of simulations in science learning to help students understand concepts, shape science attitudes, and improve science skills (Epinur & Yusnidur, 2015). Virtual laboratories also act as a change material to prepare students to conduct experiments so as to improve science process skills (Suswati & Subhan, 2021).

CONCLUSION

The effectiveness of online learning assisted by virtual laboratories olabs to measure the skills of science processes in alkaline acid matter is in the effective category, because it can improve or tier students' science process skills into 4 criteria. The t-test obtained the results that there was a significant influence of the experimental group with a sig value. 0.000 < 0.05 so Ho was rejected and Ha was accepted, so there is a difference in the average SPS before and after online learning assisted by virtual laboratory olabs. The science process skill profile of SMKN Jateng students as a whole is

in the category both with an average of 69.7 in the experimental class and in the control class 57.2 with a fairly good category.

REFFRENCES

Adnan, M., & Anwar, K. (2020). *Online learning amid the COVID-19 pandemic : Students ' perspectives*. *2*(1), 2–8.

Bahasoan, A., Ayuandiani, W., & Mukhram, M. (2020). Effectiveness of Online Learning In Pandemic Covid-19. *International Journal of Science, Technology and Management*, 100–106.

Bali, S., & Liu, M. C. (2018). Students ' perceptions toward online learning and face-to-face learning courses Students ' perceptions toward online learning and face -to-face learning courses. *Journal of Physics: Conference Series*. https://doi.org/10.1088/1742-6596/1108/1/012094

Deli, M., & Allo, G. (2020). Is the online learning good in the midst of Covid-19 Pandemic ? The case of EFL learners. *Jurnal Sinestesia*, *10*(1), 1–10.

Dhawan, S. (2020). Online Learning : A Panacea in the Time of COVID-19 Crisis. *Journal of Educational Technology*, *49(1)*, 5–22. https://doi.org/10.1177/0047239520934018

Epinur, & Yusnidur. (2015). Pengembangan Laboratorium Virtual Dengan Macromedia Flash 8 Materi Larutan Asam-Basa Untuk Kimia Dasar Ii. *Journal of The Indonesian Society of Integrated Chemistry*, *7*(2), 1–11.

Gunawan, Harjono, A., Hermansyah, & Herayanti, L. (2019). Guided inquiry model through virtual laboratory to enhance students' science process skills on heat concept. *Cakrawala Pendidikan*, *38*(2), 259–268. https://doi.org/10.21831/cp.v38i2.23345

H. Hoi, S. C., Sahoo, D., Lu, J., & Zhao, P. (2021). Online Learning: A Comprehensive Survey. *Neurocomputing*, *1*, 1–100. https://doi.org/10.1016/j.neucom.2021.04.112

Hanik, A. N., Sudarmin, & Supardi, K. I. (2019). The Development of Cooperative Learning Model Team Assisted Individualization with SETS Vision to Increase Science Process Skills. *Journal of Innovative Science Education*, *8*(1), 76–85. http://journal.unnes.ac.id/sju/index.php/jise

Hasbullah, H. (2015). Blended Learning, Trend Strategi Pembelajaran Matematika Masa Depan. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *4*(1), 49–56. https://doi.org/10.30998/formatif.v4i1.140

Indiharti, S., & Ariyatun. (2022). Efektivitas Media Laboratorium Virtual pada Pembelajaran Fisika di Era Pandemi Covid-19 Terhadap Keterampilan Proses Sains Siswa. *Jurnal Pendidikan Dan Kebudayaan*, *2*(1), 80–87.

Jaya, H. (2013). Pengembangan laboratorium virtual untuk kegiatan paraktikum dan memfasilitasi pendidikan karakter di SMK. *Jurnal Pendidikan Vokasi*, *2*(1), 81–90. https://doi.org/10.21831/jpv.v2i1.1019

Luki, N., & Kustijono, R. (2017). Pengembangan Laboratorium Virtual Berbasis Algodoo Untuk Melatihkan Keterampilan Proses Sains Siswa Pada Pokok Bahasan Gerak Parabola. *Jurnal Inovasi Pendidikan Fisika*, *06*(03), 27–35. https://jurnalmahasiswa.unesa.ac.id/index.php/inovasi-pendidikan-fisika/article/viewFile/19846/18158%0Ahttps://arxiv.org/pdf/1707.06526.pdf%0Ahttps://www.yrpri.org%0Ahttp://weekly.cnbnews.com/news/article.html?no=124000%250Ahttps://www.fordfoundation.org/%250

Maulina, R. N., & Kustijono, R. (2017). Efektifitas pembelajaran fisika berbantuan media virtual PhET disamping pelaksanaan lab riil untuk melatihkan keterampilan proses sains. *Seminarnasionalfisika(Snf)2017*, *November*, 65–69.

Migue, M. A. R. (2021). A Change in the 21 st Century : Realizing the Effect of Replacing Actual Laboratories with Virtual Laboratories. *International Journal of Science and Research (IJSR)*, *10*(10). https://doi.org/10.21275/SR211021082037

Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). E-Learning, online learning, and distance learning environments: Are they the same? *Internet and Higher Education*, *14*(2), 129–135. https://doi.org/10.1016/j.iheduc.2010.10.001

Rahayu, I. P., Sudarmin, & Sunarto, W. (2013). Penerapan Model PBL Berbantuan Media Transvisi untuk Meningkatkan SPS dan Hasil Belajar. *Chemistry in Education*, *2*(1), 17–26.

Rodrigues, P. D. (2015). The Impact of Online Learning in the Development of Speaking Skills. *Journal of Interdisciplinary Reseach in Education*, *5*(1), 43–67.

Sembiring, S., & Arisandy, D. (2016). Model Online Learning untuk Perguruan Tinggi Menggunakan Pendekatan ADDIE. *JSM STIMIK Mikroskil*, *17*(1), 29–38. https://mikroskil.ac.id/ejurnal/index.php/jsm/article/view/274

Serevina, V., & Kirana, D. (2021). The development of virtual laboratory assisted by flash and PhET to support distance learning. *Journal of Physics: Conference Series*, *2019*(1). https://doi.org/10.1088/1742-6596/2019/1/012030

Siswanto, Gumilar, S., Yusiran, & Trisnowati, E. (2018). Scientific Approach-Integrated Virtual Simulation: a Physics Learning Design To Enhance Student'S Science Process Skills (Sps). *Unnes Science Education Journal*, *7*(1), 7–12.

Sri Asmorowati, D., Wardani, S., & Widhi Mahatmanti, F. (2021). International Journal of Active Learning Analysis of Student Science Process Skills in The Practicum of Physical Chemistry Based on Linguistic and Interpersonal Intelligence. *International Journal of Active Learning*, *6*(1), 34–40. http://journal.unnes.ac.id/nju/index.php/ijal

Suswati, L., & Subhan, M. (2021). Efektivitas Virtual Laboratorium Berbantuan Software Proteus Pada Praktikum Fisika Rangkaian Listrik Terhadap Keterampilan Proses Sains Siswa. *Gravity Edu (Jurnal Pendidikan Fisika)*, *4*(1), 30–34. https://doi.org/10.33627/ge.v4i1.477

Syafrina, R., Rohman, I., & Yuliani, G. (2018). Analysis of chemical concepts as the basic of virtual laboratory development and process science skills in solubility and solubility product subject. *Journal of Physics: Conference Series*, *1013*(1). https://doi.org/10.1088/1742-6596/1013/1/012092

Syahfitri, F. D., Manurung, B., & Sudibyo, M. (2019). The Development of Problem Based Virtual Laboratory Media to Improve Science Process Skills of Students in Biology. *International Journal of Research and Review*, *6*(6), 66–74.

Trisnawati, D., & Yetri. (2019). Efektivitas Model Nht Berbantu Laboratorium Keterampilan Proses Sains Effectiveness Of The Nht Model With Virtual Laboratory Towards Learning Outcomes In Terms Of. *Indonesian Journal of Science and Mathematics Education*, *02*(2), 227–234.

Wahyu Prihmardoyo, Sajidan, M. (2017). Advances in Social Science, Education and Humanities Research (ASSEHR), volume 158. *Advances in Social Science, Education and Humanities Research (ASSEHR)*, *158*(Ictte), 958–963.