Self Organized Learning Environments (SOLE) Model Based on Blended Learning for Independence and Students' Cognitive Learning Outcomes in Acid-Base Material

Ika Budyaningsih[1*], Retno Aliyatul Fikroh[1]

[1]Chemistry Education, Sunan Kalijaga State Islamic University, Yogyakarta, Indonesia

Abstract: Educators need learning models that can increase learning independence and cognitive learning outcomes of students during distance learning, but still pay attention to the government's appeal to inhibit the spread of the Covid-19 virus. One of the learning models that can improve learning independence and cognitive learning outcomes of students during distance learning is the Self Organized Learning Environments (SOLE) learning model based on blended learning. This study aims to examine whether there is an effect of the SOLE learning model based on blended learning on the learning independence of students on acid-base material and whether there is an effect of the SOLE learning model based on blended learning on the cognitive learning outcomes of students on acid-base material. This research is quasi-experimental. The sample in this study were students of class XI MIPA 1 and XI MIPA 2 SMAN 1 Godean. The sampling technique in this study was purposive sampling. The data collection technique was carried out using a student learning independence questionnaire sheet and test questions. The data analysis technique used was the Mann-Whitney test non-parametric statistics. Based on the results of the study there is an influence of the SOLE learning model based on blended learning on the learning independence of students on acid-base material based on the results of the questionnaire and there is no effect of the SOLE learning model based on blended learning on the cognitive learning outcomes of students on the material acid-base based on test results.

Keywords: Cognitive Learning Outcomes; Independent Learning; Learning Models Self Organized Learning Environments (SOLE)

Introduction

The Covid-19 pandemic has had an impact on various fields of life, one of which is the field of education (Basar, 2021). The Indonesian government must carry out various policies to reduce the spread of the Covid-19 virus (Mawahdah, 2021). One of the policies carried out by the government is to implement social distancing (Cahyani et al., 2020). Based on the Circular Letter of the Minister of Education and Culture of Indonesia Number 4 of 2020, it is recommended that all educational institutions conduct online learning or commonly known as distance learning. The application of distance learning requires mobile devices such as smartphones or personal computers (Putria et al., 2020). According to Basar (2021), the implementation of distance learning is adjusted to the readiness of each educational institution. In fact, not all students, educators, and educational institutions have the readiness to carry out distance learning.

---

that independent learning is effective for improving learning outcomes in blended learning. In fact, not all students can do the learning independently. Based on interviews with chemistry teachers at SMAN 1 Godean stated that the level of independence in learning chemistry of students is still relatively low, so educators must be creative in implementing learning models. Learning outcomes obtained from independent learning will be better if educators use the right learning model. One of the learning models that can be used is the Self Organized Learning Environment (SOLE) learning model (Wati, 2021).

The SOLE learning model provides opportunities for students to learn independently (Firdaus et al., 2021). SOLE learning model goals improve the ability of students to think creatively, solve problems, and communicate (Wati, 2021). The stages in the SOLE learning model make students think critically and deeply about the material they are studying. the nature of sensitivity and carefulness in analyzing a matter can refer to the formation of the mindset of each learner (Fariha & Amalia, 2021). Based on research conducted by Kusasi (2021) shows that the SOLE learning model can improve students' cognitive learning outcomes when learning online on gas kinetic theory material. A similar study conducted by Firdaus et al., (2021) shows that the SOLE learning model can increase students' learning independence in thematic material for fourth grade elementary school.

The SOLE learning model can be applied to chemistry subjects. Chemistry subjects are part of the natural sciences which has many concepts. Chemistry is considered as one of the subjects that is difficult for most students because it consists of abstract concepts (Zammiluni et al., 2018). This is reinforced by interviews with chemistry teachers at SMAN 1 Godean who stated that many students had difficulties in learning chemistry because it consisted of many concepts. Interviews were also conducted on the chemistry teacher at SMAN 1 Gamping who stated that chemistry subjects were considered difficult by students as evidenced by the low cognitive learning outcomes. The results of interviews with chemistry teachers at MAN 2 Kulon Progo also stated that chemistry subjects were considered difficult because there were many chemical reactions and calculations. Cognitive learning outcomes of chemistry subjects are classified as low, especially on acid-base materials.

Acid-base is considered as one of the difficult materials in chemistry subjects because it is a complex material, many calculations, interconnected, and requires several stages to understand the concept (Izza et al., 2021). Based on an interview with a chemistry teacher at SMAN 1 Godean, it was stated that the difficulty of students in acid-base material lies in the chemical reaction and pH calculations. In addition, acid-base material also requires direct practice and explanation to increase the level of understanding of students. This is in accordance with the research of Irsalina & Dwiningsih (2018) which states that one way to improve students' understanding of acid-base material is through experiments and connecting them with everyday phenomena. Therefore, learning strategies are needed that can overcome these problems, but still pay attention to the government's appeal in order to inhibit the spread of the Covid-19 virus. The learning strategy that can be used to overcome these problems is to apply the blended learning method.

Blended learnings a combination of face-to-face learning with e-learning that can be done by anyone, anytime, and anywhere (Rachman et al., 2019). In general, the purpose of blended learning is to make students learn more actively and independently without reducing meeting time in class (Puspita & Tirtoni, 2023). Learners can study independently outside the classroom by accessing materials online, but there is still communication between students and educators with students that occurs outside of learning hours using this learning method (Zainuddin & Keumala, 2018). The results of Uyun (2022), research shows that blended learning learning can improve student learning outcomes. A similar study conducted by Musdalifa et al., (2020) showed that there was a positive influence on the use of blended learning based on the Edmodo social network in the discovery learning model on the cognitive learning outcomes of students on the buffer solution material.

Based on this background, research related to the SOLE learning model based on blended learning has never been done, so it is necessary to do research related to the SOLE learning model based on blended learning. The research that will be conducted is entitled "The Effect of Self Organized Learning Environments (SOLE) Learning Model Based on Blended Learning on Independent Learning and Cognitive Learning Outcomes of Students on Acid-Base Materials". The application of the SOLE learning model based on blended learning is expected to increase learning independence and cognitive learning outcomes of students.

Method

This research is quasi-experimental research, namely a method that has a control group, but cannot control external variables that affect the full implementation of the experiment (Sugiyono, 2018). The design used in this study was a non-equivalent control group design with pretest-posttest. This study used two classes, namely the experimental class and the control class. The experimental class was treated with the Self Organized Learning Environments (SOLE) model based on blended learning, while the control class was treated with the direct

on blended learning, while the control class was treated with the direct instruction model in the learning process. Both classes were given pre-test questions before delivering the material to determine the students' initial abilities. After the acid-base material was delivered to the experimental class and control class, students are given post-test questions to determine the final ability of students after being given treatment. The research design used in the experimental class and control class can be seen in Table 1.

Table 1 Research Design Experiment Class and Control Class

Class	Pretest	Treatment	Posttest
Experiment	O1	X1	O2
Control	O3	X2	O4

Information:

O1: experimental class pre-test results

O2: experimental class post-test results

O3: control class pre-test results

O4: control class post-test results

X1: treatment of the experimental class of the Self Organized Learning Environments (SOLE) learning model based on blended learning

X2: treatment of the control class of direct instruction learning model

This research was conducted at SMAN 1 Godean which is located at Sidokarto Street Number 5, Sidokarto, Godean District, Sleman Regency, Yogyakarta Special Region 55564 in the even semester of the 2021/2022 academic year. The population in this study were all students of class XI MIPA in the even semester of SMAN 1 Godean for the academic year 2021/2022, totaling 142 students and divided into 4 classes, namely class XI MIPA 1, XI MIPA 2, XI MIPA 3, and XI MIPA 4. The research sample is XI MIPA 1 as the experimental class, totaling 36 students and XI MIPA 2 as the control class, totaling 36 students. The sampling technique used is non probability sampling, namely purposive sampling.

The data collection of the students' learning independence was obtained through the questionnaire instrument of the students' learning independence which was given after the treatment. The instrument of the questionnaire sheet was tested for validity by expert lecturers and then an empirical test was carried out by testing the validity and reliability of the instrument. The questionnaire instrument contains 37 statements consisting of favorable and unfavorable statements.

Data on students' cognitive learning outcomes were obtained through test questions. The test questions were given before and after the treatment. The test items were tested for validity by expert lecturers and then empirical tests were carried out by testing the validity, reliability, discriminating power, and level of difficulty of the questions. The question instrument consists of 25 multiple choice questions.

The data analysis technique for learning independence and cognitive learning outcomes of students uses a hypothesis test that was previously tested for prerequisites, namely the normality test using the Kolmogorov-Smirnov test and the homogeneity test using the Levene Statistic test. If the prerequisites are met, then the statistical test is carried out using the T test, while if one of the prerequisites is not met, the non-parametric statistical test is carried out, namely the Mann-Whitney test.

Results and Discussion

Independent Learning of Students

Students' learning independence was obtained through a student learning independence questionnaire which was distributed to the experimental class and control class after treatment. Descriptive statistics on the learning independence of students in the experimental class and control class can be seen in **Error! Reference source not found.** and Table 3.

Table 2. Statistical Descriptive Test Results of Learning Independence of Experimental Class Student (Descriptive Statistics)

	N	Min	Max	mean	Std. Deviation
Learning Independence Questionnaire Results	36	106	180	141.33	19.931

Valid N (listwise)	36				

Table 3. Statistical Descriptive Test Results of Learning Independence of Control Class Students Descriptive Statistics)

	N	Min	Max	mean	Std. Deviation
Learning Independence Questionnaire Results	36	100	172	130.72	18.988
Valid N (listwise)	36				

Based on **Error! Reference source not found.** it can be seen that the average score of learning independence of experimental class students is 141.33 with the highest score of 180 and the lowest score of 106. Based on Table 3 it can be seen that the average score of learning independence of control class students is 130.72 with the highest score of 172 and the lowest score of 100.

Before carrying out statistical tests, prerequisite tests are needed, namely normality tests and homogeneity tests of students' learning independence data. According to Nurcahyo & Riskayanto (2018), the data is normally distributed if it has a significance value of more than 0.05 (Sig. > 0.05). The population is said to be homogeneous if the significance value is > 0.05 (Usmadi, 2020). The results of the normality and homogeneity test of students learning independence can be seen in **Error! Reference source not found.** and Table **5**.

Table 4. The Results of the Normality Test for Students' Learning Independence

	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Learning Independence	Experiment Class	.090	36	.200*	.972	36	.486
Questionnaire Results	Control Class	.083	36	.200*	.970	36	.433

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Table 5. The Results of the Homogeneity Test of Students' Learning Independence

Learning Independence Questionnaire Results

Levene Statistics	df1	df2	Sig.
.187	1	70	.666

Based on **Error! Reference source not found.** significance value of both classes is more than 0.05 (Sig. > 0.05), so it can be concluded that the learning independence data of the experimental class and control class students are normally distributed. Based on the homogeneity test on Table **5** obtained a significance value exceeding 0.05 (Sig. > 0.05), so it can be concluded that the learning independence data of students in the experimental class and control class are homogeneous.

Student learning independence data is ordinal data, so a non-parametric statistical test was conducted using the Mann-Whitney test. According to Heryana (2020), nonparametric statistics are used to analyze ordinal data. The results of the Mann-Whitney test can be seen in **Error! Reference source not found.**.

Table 6. The Results of the Mann Whitney Test Analysis of Independent Learning for Students

	Learning Independence Questionnaire Results
Mann-Whitney U	454.500
Wilcoxon W	1120.500
Z	-2.180

asymp. Sig. (2-tailed)	.029

a. Grouping Variable: Class

Based on **Error! Reference source not found.** sig value. (2-tailed) 0.029 or less than 0.05 then H_0 is rejected, meaning that there is an influence from the use of the SOLE learning model based on blended learning on the learning independence of students based on the results of the questionnaire. This is in line with the research of Marlina (2022), that there is a significant influence on the use of the online-based Self Organized Learning Environments (SOLE) learning model on the learning independence of students. Study Fariha & Amalia (2021) also stated that in the online learning process using the SOLE learning model can increase the activeness and learning independence of students.

Cognitive Learning Outcomes of Students

Data on students' cognitive learning outcomes were obtained based on the results of the pretest and posttest. The pretest was given before the treatment to determine the students' initial abilities, while the posttest was given after being given treatment to measure the students' final abilities in the experimental class and control class. Descriptive statistics on cognitive learning outcomes of experimental class and control class students can be seen in Table 7.

Table 7. Statistical Descriptive Test Results of Students' Cognitive Learning Outcomes

	N	Min	Max	mean	Std. Deviation
PreTest Experiment	36	44	80	69.33	8.000
PostTest Experiment	36	68	100	94.89	8.369
PreTest Control	36	28	88	53.56	17.456
PostTest Control	36	72	100	95.11	7.098
Valid N (listwise)	36				

Based on Table 7 the average score of the pre-test results in the experimental class was 69.33, while the average score of the pre-test results in the control class was 53.56. The average score of the post-test results in the experimental class was 94.89, while the average score of the post-test results in the control class was 95.11. The pre-test and post-test scores that have been obtained are then tested for hypotheses to determine whether there are differences in cognitive learning outcomes between the experimental class using the SOLE model based on blended learning and the control class using the direct instruction learning model based on the test results. Before testing the hypothesis, a prerequisite test is carried out, namely normality and homogeneity tests. The results of the normality and homogeneity of students' cognitive learning outcomes can be seen in

Table 8 and **Error! Reference source not found.**.

Table 8. The Results of the Normality Test of Learners' Cognitive Learning Outcomes

	Class	Kolmogorov-Smirnova			Shapiro-Wilk		
		Statistics	df	Sig.	Statistics	df	Sig.
Student Learning Outcomes	Pre-test Experiment	.212	36	.000	.821	36	.000
	Post-test Experiment	.313	36	.000	.678	36	.000
	Pre-test Control	.097	36	.200*	.955	36	.149
	Post-test Control	.300	36	.000	.716	36	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 9. The Results of the Homogeneity Test of Students' Cognitive Learning Outcomes

Student Learning Outcomes

Levene Statistics	df1	df2	Sig.
.913	1	70	.343

Table 8 Error! Reference source not found.Error! Reference source not found.the significance value of the experimental class pre-test is less than 0.05, it can be said that the pre-test data is not normally distributed, while the significance value of the control class's pre-test data is more than 0.05 then the data is said to be normally distributed. Normality test was also carried out on post-test data. Based on the post-test data normality test, the experimental class and the control class are 0.000 and 0.000, respectively. The value of the two data shows less than 0.05 then the data is said to be not normally distributed. According to Sugiyono (2018), the cause of the data not being normally distributed is due to sorted data, extreme data, and other causes. The test results in this study are not normally distributed because there are outliers or extreme data that have values that are very far from other data. The second prerequisite test is the homogeneity test. Based on **Error! Reference source not found.** obtained a significance value of more than 0.05

Based on (Sig. > 0.05) which is 0.343. This shows that the test scores of the experimental class and the control class have the same variance or are homogeneous.

After the prerequisite test is met, the next step is to test the hypothesis. The statistical hypothesis test used on the students' cognitive learning outcomes data was the Mann-Whitney non-parametric test because the pre-test and post-test data for the experimental class and the control class were not normally distributed. The results of the Mann-Whitney test can be seen in **Error! Reference source not found.**.

Table 10. The Results of the Mann Whitney Test Analysis of Students' Cognitive Learning Outcomes

	Student Learning Outcomes
Mann-Whitney U	606.500
Wilcoxon W	1272.500
Z	-.509
asymp. Sig. (2-tailed)	.611

a. Grouping Variable: Class

Based on **Error! Reference source not found. Error! Reference source not found.**sig value is obtained. (2-tailed) 0.611 which means greater than 0.05 then H_0 is accepted, meaning that there is no significant effect on the SOLE model based on blended learning on the cognitive learning outcomes of students on acid-base material based on test results. The results of this study contradict the research of Kusasi (2021) and research of Rahmawati (2022) which state that the SOLE learning model can improve student learning outcomes. Possible things that cause there is no effect of the SOLE learning model based on blended learning on the cognitive learning outcomes of students on acid-base material because the sampling technique used is not appropriate, resulting in an unrepresentative sample. According to Susanti *et al.*, (2018) a good sampling technique used in experimental research is a random sampling technique to get a representative sample.

Conclusion

Based on the results of the research and discussion, it is concluded that there is a significant influence of the blended learning-based Self Organized Learning Environments (SOLE) learning model on student learning independence in the basic material based on the results of the questionnaire and there is no significant influence of the Self Organized Learning Environments (SOLE) learning model blended learning-based learning on students' cognitive learning outcomes in acid-base material based on test results.

Reference

Basar, A. M. (2021). Problematika Pembelajaran Jarak Jauh Pada Masa Pandemi Covid-19 (Studi Kasus di SMPIT Nurul Fajri – Cikarang Barat – Bekasi). *Jurnal Ilmiah Pendidikan*, 2(1), 208-218. https://doi.org/10.51276/edu.v2i1.112.

Cahyani, A., Iin. D. L., & Sari, P. D. L. (2020). Motivasi Belajar Siswa SMA pada Pembelajaran Daring di Masa Pandemi Covid-19. *IQ (Ilmu Al-Qur'an): Jurnal Pendidikan Islam*, 3(01), 123–140. https://doi.org/10.37542/iq.v3i01.57.

Fariha, A., & Nur, A. (2021). Pembelajaran SOLE dalam Membangun Keefektifan Belajar pada Peserta Didik. *Edudikara : Jurnal Pendidikan dan Pembelajaran*, 6(3), 152–157. https://doi.org/10.32585/edudikara.v6i3.245.

Firdaus, F. M., *et al.* (2021). Meningkatkan Kemandirian Belajar Peserta Didik Sekolah Dasar Menggunakan Model SOLE Saat Pandemi Covid-19. *Jurnal Foundasia*, 12(1), 1–8. https://doi.org/10.21831/foundasia.v12i1.37786.

Geng, S., Kris, M. Y. L., & Ben, N. (2019). Investigating Self-Directed Learning and Technology Readiness in Blending Learning Environment. *International Journal of Educational Technology in Higher Education*, 16(17), 1-22. https://doi.org/10.1186/s41239-019-0147-0.

Heryana, A. (2020). Uji Statistik Non Parametrik. *Catatan Ade Heryana*, May, 1–21. https://doi.org/10.13140/RG.2.2.33332.48000.

Irsalina, A., & Kusumawati, D. (2018). Practicality Analysis of Developing the Student Worksheet Oriented Blended Learning in Acid Base Material. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, 3(3), 171-182. https://doi.org/10.20961/jkpk.v3i3.25648.

Izza, R. I., Nurhamidah, & Elvinawati. (2021). Analisis Miskonsepsi Siswa Menggunakan Tes Diagnostik Esai Berbantuan Cri (Certainty of Response Index) Pada Pokok Bahasan Asam Basa. *Alotrop*, 5(1), 55–63. https://doi.org/10.33369/atp.v5i1.16487

Kusasi, A. (2021). Penggunaan Model SOLE untuk Meningkatkan Hasil Belajar Daring Peserta Didik Materi Teori Kinetik Gas. *Jurnal Ilmiah Pendidikan Fisika*, 5(2), 175-185. https://doi.org/10.20527/jipf.v5i2.2833.

Marlina, D. (2022). Pengaruh Model Pembelajaran SOLE (Self Organized Learning Environments) Berbasis Daring terhadap Kemandirian Belajar Siswa SD. *Jurnal Ilmiah Pendidikan Dasar*, 5(1), 60–70. http://dx.doi.org/10.33603/.v4i2.6263.

Mawahdah, Z. (2021). Implementasi Model Pembelajaran Blended Learning di Kelas V Sekolah Dasar pada Masa Pandemi Covid-19. *Skripsi*. Jurusan Pendidikan Anak Usia Dini dan Dasar. Fakultas Keguruan dan Ilmu Pendidikan. Universitas Jambi. Retrieved from https://repository.unja.ac.id/id/eprint/15968.

Menteri Pendidikan dan Kebudayaan Indonesia. (2020). *Surat Edaran Menteri Pendidikan dan Kebudayaan Indonesia Nomor 4 Tahun 2020 tentang Pelaksanaan Kebijakan Pendidikan dalam Masa Darurat Penyebaran Corona Virus Disease (Covid- 19)*.

Musdalifa, Ramdani, & Muhammad, D. (2020). Pengaruh Blended Learning Berbasis Jejaring Sosial Edmodo pada Model Discovery Learning terhadap Hasil Belajar Peserta Didik (Studi pada Materi Pokok Larutan Penyangga). *Chemica: Jurnal Ilmiah Kimia dan Pendidikan Kimia*, 21(1), 59–69. https://doi.org/10.35580/chemica.v21i1.14839.

Nurcahyo, B., & Riskayanto. (2018). Analisis Dampak Penciptaan Brand Image dan Aktifitas Word of Mouth (WOM) pada Penguatan Keputusan Pembelian Produk Fashion. *Jurnal Nusantara Aplikasi Manajemen Bisnis*, 3(1), 14 – 29. https://doi.org/10.29407/nusamba.v3i1.12026.

Puspita, K. A., & Feri, T. (2023). Pengaruh Model Pembelajaran Blended Learning terhadap Hasil Belajar Siswa Sekolah Dasar. *Lectura : Jurnal Pendidikan*, 14(1), 85–98.

https://doi.org/10.31849/lectura.v14i1.12031.

Putria, H., Luthfi, H. M., & Din, A. U. (2020). Analisis Proses Pembelajaran dalam Jaringan (DARING) Masa Pandemi Covid- 19 pada Guru Sekolah Dasar. *Jurnal Basicedu*, 4(4), 861–870. https://doi.org/10.31004/basicedu.v4i4.460.

Rachman, A., Yusep, S., & Dedi, R. (2019). Penerapan Model Blended Learning dalam Peningkatan Hasil Belajar Menggambar Objek 2 Dimensi. *Journal of Mechanical Engineering Education*, 6(2), 145–152. Retrieved from https://ejournal.upi.edu/index.php/jmee/article/view/21784.

Rahmawati, F. (2022). Meningkatkan Keaktifan dan Hasil Belajar Informatika Menggunakan Model Self Organized Learning Environment. *JPIn: Jurnal Pendidik* Indonesia, 5(1), 111–117. https://doi.org/10.47165/jpin.v5i1.252.

Sugiyono. (2018). *Statistik Non Parametris untuk Penelitian*. Bandung: Alfabeta.

Susanti, A., Ria A. A. S., & Hitapriya, S. (2018). Pencarian Rumus Perhitungan Jumlah Sampel Minimal yang Digunakan Pada Penelitian Perilaku Perjalanan Terdahulu Searching for Minimum Number of Sample Formula Used in Previous. *Jurnal Manajemen Aset Infrastruktur & Fasilitasurnal Manajemen Aset Infrastruktur & Fasilitas*, 2(2), 53–64. http://dx.doi.org/10.12962/j26151847.v2i0.4824.

Usmadi, U. (2020). Pengujian Persyaratan Analisis (Uji Homogenitas Dan Uji Normalitas). *Inovasi Pendidikan*, 7(1), 50–62. https://doi.org/10.31869/ip.v7i1.2281.

Uyun, M. Peningkatan Hasil Belajar Matematika Siswa dengan Menggunakan Model Pembelajaran Blended Learning . *JUPE: Jurnal Pendidikan Mandala*, 7(1), 195–199. Retrieved from http://ejournal.mandalanursa.org/index.php/JUPE/index.

Wati, N. N. K. (2021). Implementasi Model Pembelajaran Self Organized Learning Environments Berbasis Tri Kaya Parisudha untuk Meningkatkan Hasil Belajar Mahasiswa. *Jurnal Pendidikan Dasar*, 2(1), 1–10. Retrieved from http://jurnal.stahnmpukuturan.ac.id/index.php/edukasi.

Zainuddin, Z., & Cut, M. K. (2018). Blended Learning Method Within Indonesian Higher Education Institutions. *Jurnal Pendidikan Humaniora*, 6(2), 69–77. Retrieved from http://journal.um.ac.id/index.php/jph.

Zammiluni, Allizar, U., & Mawardi. (2018). Development of Guided Inquiry Based Work Sheet with Class and Laboratory Activity on Chemical Bonding Topic in Senior High School. International Journal of Chemistry Education Research, 2(2), 60–66.. https://doi.org/10.20885/ijcer.vol2.iss2.art1