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Project-Based Effectiveness with Digital Literacy Blended Learning (DLBL) to Improve Cognitive Abilities in Electrochemical Subjects

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Abstract

This research aims to measure the effectiveness of the Digital Literacy Blended Learning (BLDD) method with a project-based learning model to increase students' cognitive abilities in electrochemistry. The research subjects were 30 students who took Engineering Chemistry courses at the Faculty of Engineering, University Wisnuwardhana Malang. The research design was a quasi-experimental version of one group pre-post test only. The instrument uses test and non-test. The test instrument was analyzed using the Kolmogorov-Smirnov technique normality test, the Anova linearity test, and the correlation test using the SPSS 26 program. The non-test instrument with a questionnaire using a Likert scale was analyzed to calculate frequency and TCR. The results showed that the normality test was 0,180 with a linear relationship with a p-value (0,428) > 0,05. This indicated that students' cognitive abilities increased, supported by a correlation test value of 0,382 with a significance level of 0,037. Analysis of the treatment questionnaire results shows an average frequency of 4,52 and a TCR of 83,64, indicating that this method's treatment is very good. The Blended Learning Literacy (BLDD) strategy effectively improves students' cognitive understanding of electrochemical material.

1. INTRODUCTION

Blended Learning in the 4.0 learning era has begun to be widely implemented in the world of education because of the progress of the times and changes in learning perspectives that utilize information technology so that learning activities are more meaningful and train learning independence. Blended learning activities utilize three quadrants: virtual synchronous, asynchronous, and collaborative. Its presentation requires learning innovation and creativity that is no less interesting than face-to-face learning in a lesson. Blended learning combines confront-to-confront and virtual strategies. By combining these two strategies, it is accepted to be able to extend activeness, freedom, and constructivism in learning(C. A. Dewi et al., 2022). The constrained face-to-face interaction has decreased school hours and brought about understudies having trouble understanding the lesson and completing assignments given by the instructor, and this caused a

decrease in learning results(Ningsih & Jayanti, 2022). In blended learning, interesting scenarios are needed to give genuinely challenging learning air and a great learning encounter(Fitriana et al., 2022).In between online learning activities, students can further explore their knowledge by browsing material, working on assignments, and online discussions. One learning strategy that can make the presentation of blended learning more curious and challenging is extend-based learning (PJBL). PJBL practices have been successful in giving meaning to learning encounters(Rizal et al., 2020). Planning mixed learning in online learning by joining the PjBL methodology will make the execution of talk gatherings and dynamic free, collaborative, and online task work conceivable. Understudies can intuitively express their contemplations into concrete arrangements so that they can be changed over into inventive and inventive items. PjBL-based online learning activities can promise curious learning exercises, beginning from the organization of building essential questions related to issue issues, gathering data that supports the writing to fathom essential questions, and planning the strategy utilized in fathoming issues.

PJBl activities in blended learning need to be supported by digital literacy. Digital literacy strongly supports learning activities with blended learning(Gestira et al., 2021). Digital literacy is understanding and using information from various sources accessed via computer devices(Masitoh, 2018). With digital literacy, students can be more economical in finding sources of teaching materials and using online learning applications that save data packages and do not burden students.

2. METHOD

This experiment used a quasi-experimental plan (quasi-experimental). Pseudo-experiments to discover the relationship of certain factors(Nasir et al., 2022). In this regard, the subjects got the same treatment, specifically utilizing digital literacy blended learning (DLBL) with a project-based learning technique. Experimental The design of this study was to gather pre-post tests as they formed. Blended learning with a project-based learning plan can be connected to three learning quadrants, to be specific: virtual synchronous, asynchronous autonomous, and collaborative offbeat. The populace and test were 30 understudies who took Building Chemistry courses at the Faculty of Engineering, College of Wisnuwardhana Malang, who took Engineering Chemistry courses for the 2022-2023 scholarly year. The sample selection technique uses the census method, where all individuals of the populace are utilized to inquire about tests. The census is a sampling technique in which all population members are used as samples.

The instruments used in the study consisted of test sheets and student response questionnaires. The test instrument is in the form of questions to measure students' cognition. Data analysis used (1) Normality test with the Kolmogorov-Smirnov technique. The ordinariness test points to decide whether the values are normally distributed. Regular if the significance value is > 0.05. (2) ANOVA linearity test, 3) Correlation test analyzed using SPSS 26 program. The instrument used the Likert scale with Frequency Analysis and TCR using SPSS 26 for the questionnaire.

3. RESULTS AND DISCUSSION

Education must adapt to digital technology; increasingly sophisticated technology can facilitate learning (Setiowati et al., 2021). The advancement of chemistry within the millennial time in instruction is by utilizing the advancement of information and communication innovation within the preparation of learning exercises(Irsalina & Dwiningsih, 2018). The ability of students to construct their understanding regarding electrochemical material can be measured by the cognitive power acquired. Data analysis was obtained from the pretest and posttest, which were applied after the lectures were carried out using blended learning Literacy using the project-based learning method. In addition, an analysis was also carried out with a questionnaire given to students

A. Digital literacy blended learning

Technological advances in the era of the Industrial Revolution 4.0 demand that the world of instruction must instantly make comprehensive changes in line with the enormous improvement of computerized innovation. Blended learning increases learning hours outside the classroom as a substitute for face-to-face processes in class(Mufarohah & Dwiningsih, 2018). Online learning uses digital technology(Jamilah et al., 2021). Blended learning is indispensable in supporting deep learning(Fitriana, 2018).

The digitalization of innovation within the instruction world has caused behavioral changes in learning exercises, learning assets, and learning models. The development of e-learning, online

learning, web-based preparation, online courses, web-based education, and so on may be a solid flag of the changing requests of learning frameworks and instructive methodologies in common. The 4.0 instruction worldview requests a principal and indeed comprehensive transformation within the learning framework and execution of instruction in general so that the most columns of instruction in this 4.0 period are computers, the web, and substance. In this manner, changing instructional resources in digital form based on the web could be a vital step to showing school/campus life (culture school) past the limits of time and space (boundless school).

In this setting, computerized proficiency is a critical requirement for school citizens nowadays since mechanical advancements not coordinated by insights in utilizing present-day innovative gadgets will hurt human civilization. Digital literacy is urgently needed today (Nada & Sari, 2020). In this manner, computerized education must also be caught on as an ability to utilize computers, the web, and other advanced apparatuses so that computerized proficiency can be translated as an exertion to know, look, get, analyze, and utilize innovative advances. The point of view on instruction has experienced a critical move at first learning activities as it was centered on the method of retaining information (exchange of information and abilities) by taking after the advice and information of the teacher/lecturer, centering on assessment within the frame of cognitive tests and evaluations which were exceptionally thorough and constrained. (face-to-face learning). This conventional learning model has advantages, including teachers/lecturers being able to monitor students' learning progress directly.

B. Measurement of cognitive ability with Project-based learning

The scores of students' cognitive capacities within the intercession gathered utilizing the PjBL strategy experienced a noteworthy increment.

Normality Test

The examination procedure utilized in this consideration is the relationship strategy by analyzing the normality test prerequisites. The data normality test is intended to test the assumption that the sample mean is close to the average population. Its use is to find out and provide confidence whether the data is around or close to the standard line. The information ordinariness test was carried out utilizing the SPSS form 26 program and tolerating or dismissing a typical choice whether or not the information was set at a critical level of α = 0.05. Respondents in this survey were 30 individuals. Table 1. Student Ability Score

Table 1. Kolmogorov-smirnov analysis results

One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		31
Normal Parameters[b]	Mean	.0000000
	Std. Deviation	3.41268645
Most Extreme Differences	Absolute	.132
	Positive	.068
	Negative	-.132
Test Statistic		.132
Asymp. Sig. (2-tailed)		.180[c]

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

Based on the SPSS yield table, it is known that the importance esteem of Asiymp. Sig (2-tailed) is 0.180, which is more prominent than 0.005. So, the information is regularly disseminated, concurring with the premise for choice-making within the Kolmogorov-Smirnov typicality test. This way, the presumptions and requirements for typicality within the relapse show have been met.

Linearity Test

The linearity test was tried utilizing the Compare Implies test for linearity with the assistance of the SPSS 26.00 program. Linearity suggests a relationship between the free variable (predictor) and the subordinate factors (criteria) that commonly frame a straight bend. The linearity test is utilized to see the relationship between the factors of Advanced education mixed learning (DLBL). Utilizing the Extend-based learning demonstration has an impact.

Table 2. Cognitive abilities

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Postest * Pretest	Between Groups	(Combined)	163.119	9	18.124	1.484	.220
		Linearity	59.577	1	59.577	4.878	.039
		Deviation from Linearity	103.542	8	12.943	1.060	.428
	Within Groups		244.248	20	12.212		
	Total		407.367	29			

Based on the linearity test table 2, it can be seen that each variable forms a linear curve with a p-value (0.428) > 0.05. While F count = 1.060 <F table = 4.20. The F table number is obtained from the data distribution distribution table of F values with a probability of 5%. So, the F table value is found to be 4.20. Thus, because the probability value is> 0.05 and the F count>F table value, it can be concluded that Digital literacy blended learning (DLBL) Using the Project-based learning model on cognitive abilities has a linear relationship

Correlation Test

Table 3. Correlation test table

Correlations

		Pretest	Postest
Pretest	Pearson Correlation	1	.382*
	Sig. (2-tailed)		.037
	N	30	30
Postest	Pearson Correlation	.382*	1
	Sig. (2-tailed)	.037	
	N	30	30

***. Correlation is significant at the 0.05 level (2-tailed).**

Based on the calculations in Table 3, the results show that the correlation coefficient between Digital literacy blended learning (DLBL) Using the Project-based learning model on cognitive abilities appears that the relationship esteem is 0.382 with an importance level of 0.037 where this price is <0.05. This follows the Basis for decision-making <0.05, so it is correlated. Based on these results, it is known that Digital literacy blended learning (DLBL) Using the Project-based learning model has an effect on cognitive abilities, which has a positive relationship.

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C. The results of the Digital literacy blended learning (DLBL) Lecture Questionnaire using the Project-based learning model

The project-based learning demonstration has the advantage that understudies can be spurred into learning(Haryati et al., 2020). Project-Based Learning (PjBL) requires a comprehensive instructing approach in which the understudy learning environment is planned so that understudies can examine real issues (Berhitu et al., 2020). Digital literacy could be a person's capacity to get and utilize data sourced from different computerized computing frameworks(N. et al. et al., 2013). Digital literacy is a pressing requirement for school citizens nowadays since innovative improvements that need to be coordinated by insights into utilizing cutting-edge mechanical gadgets will harm human civilization. Therefore, digital literacy must also be understood as a skill, Data was presented in table 4.

Table 4. Frequencies of the question for respondents

Statistics		X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15
N	V	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
	M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mean		4.40	4.50	4.43	4.20	4.60	4.40	4.33	4.50	4.17	2.87	2.73	4.37	4.43	4.30	4.47
Std. Error of Mean		.113	.104	.114	.139	.103	.103	.138	.104	.167	.257	.253	.112	.104	.109	.115
Median		4.0	5.0	4.50	4.00	5.00	4.00	4.5	5.0	4.0	3.0	2.0	4.0	4.0	4.0	5.0
Mode		4[a]	5	5	4	5	4	5	5	4	2	2	4	4	4	5
Std. Dev		.621	.572	.626	.761	.563	.563	.758	.572	.913	1.408	1.388	.615	.568	.596	.629
Variance		.386	.328	.392	.579	.317	.317	.575	.328	.833	1.982	1.926	.378	.323	.355	.395
Range		2	2	2	3	2	2	2	2	4	4	4	2	2	2	2
Min		3	3	3	2	3	3	3	3	1	1	1	3	3	3	3
Max		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Sum		132	135	133	126	138	132	130	135	125	86	82	131	133	129	134

a. Multiple modes exist. The smallest value is shown

While looking for the level of attainment of respondents' answers, used the following formula:

$$TCR = \frac{score\ average}{5} x100\% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

TCR = Level of Achievement of Respondents' Answers. Furthermore, the calculation results of the comparison between the genuine score and the perfect score are contributed by the table 5.

Table 5. Criteria for the percentage of respondent's score

Total score (%)	Criteria
20.00-36.00	Not good
36.01-52.00	Deficient
52.01-68.00	Enough
68.01-84.00	Good
84.01-100	Very Good

Table 6 presents data from students who gave happy answers to blended learning activities with digital literacy. Besides that, using PJBL as a learning strategy is considered quite good in electrochemical materials.

Table 6. Results of Analysis of the Level of Achievement of Respondent A based on Respondent's Answer Frequency (N)

Ques.	Criteria					N	Score	MEAN	TCR	Category
	SS	S	R	TS	STS					
1	14	14	2	0	0	30	132	4.4	88	**Very Good**
2	16	13	1	0	0	30	135	4.5	90	**Very Good**
3	15	13	2	0	0	30	133	4.433333	88.66667	**Very Good**
4	11	15	3	1	0	30	126	4.2	84	**Good**
5	19	10	1	0	0	30	138	4.6	92	**Very Good**
6	13	16	1	0	0	30	132	4.4	88	**Very Good**
7	15	10	5	0	0	30	130	4.333333	86.66667	**Very Good**
8	16	13	1	0	0	30	135	4.5	90	**Very Good**
9	12	13	4	1	0	30	126	4.2	84	**Very Good**
10	5	6	5	8	6	30	86	2.866667	57.33333	**Enough**
11	5	4	5	10	6	30	82	2.733333	54.66667	**Enough**
12	13	15	2	0	0	30	131	4.366667	87.33333	**Very Good**
13	14	15	1	0	0	30	133	4.433333	88.66667	**Very Good**
14	11	17	2	0	0	30	129	4.3	86	**Very Good**
15	16	12	2	0	0	30	134	4.466667	89.33333	**Very Good**

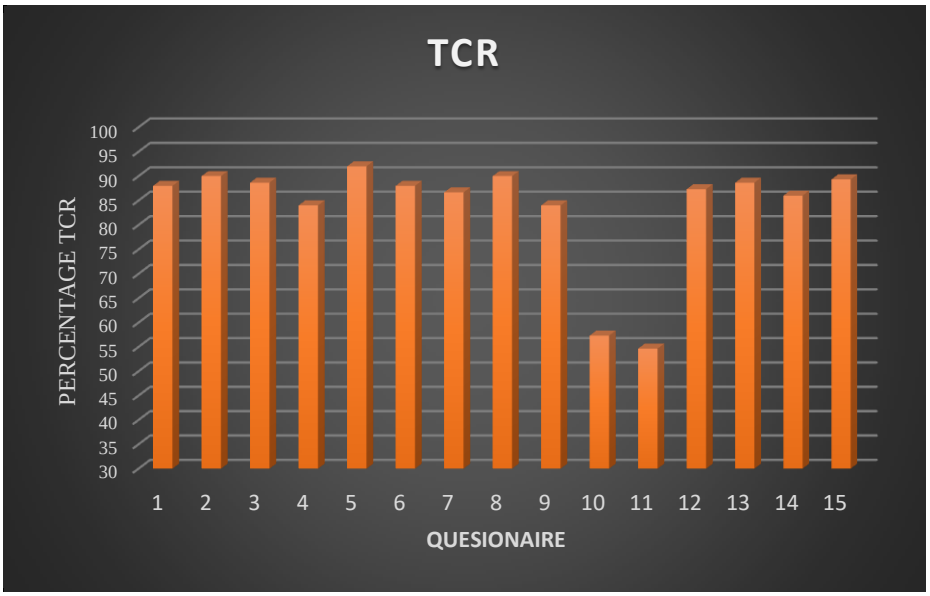

Figure 1. TCR Chart

Based on the analysis of the average value, the score of the respondents' results, and the TCR, the Figure 1. shows that students responded well to this lesson.

4. CONCLUSION

Based on the discussion in this study, it was concluded that Digital literacy blended learning (DLBL) with a problem-based learning model proved effective in increasing students' cognitive abilities for Electrochemistry material based on test analysis data in the form of pretest and posttest, which showed that cognitive abilities increased with test results the normality significance value of Asiymp. Sig (2-tailed) is 0.180, the linear relationship is the p-value (0.428) > 0.05, and the correlation test value is 0.382 with a significance level of 0.037. Analysis of the treatment questionnaire results showed an average frequency of 4.52 and a TCR of 83.64, indicating that the treatment of this method was very good at increasing understanding of electrochemical material using Digital literacy blended learning (DLBL).

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REFERENCES

Dewi, C. A., Awaliyah, N., Fitriana, N., Darmayani, S., Nasrullah, Setiawan, J., & Irwanto, I. (2022). Using Android-Based E-Module to Improve Students' Digital Literacy on Chemical Bonding. *International Journal of Interactive Mobile Technologies*, *16*(22), 191–208. https://doi.org/10.3991/ijim.v16i22.34151

Dewi, N. L., Dantes, N., & Sadia, I. W. (2013). Pengaruh Model Pembelajaran Inkuiri Terbimbing Terhadap Sikap Ilmiah dan Hasil Belajar IPA. *Jurnal Program Pascasarjana Universitas Pendidikan Ganesha*.

Fitriana, N. (2018). Penerapan Model Pembelajaran Blended Learning Pada Mata Kuliah Pemisahan Kimia Materi Kromatografi Untuk Meningkatkan Kualitas Belajar. *Erudio Journal of Educational Innovation*.

Fitriana, N., Balol, W., Sunyoto, S., & Aziz, A. S. (2022). Blended Learning Materi Kimia Industri Menggunakan Zoom Meeting. *EDUKATIF : JURNAL ILMU PENDIDIKAN*, *4*(4). https://doi.org/10.31004/edukatif.v4i4.2934

Gestira, M., Abdurrahman, & Viyanti. (2021). PjBL-Based Blended Learning Implementation on Energy Topic to Improve the Problem-Solving Skill. *Impulse: Journal of Research and Innovation in Physics Education*, *1*(1). https://doi.org/10.14421/impulse.2021.11-04

Haryati, T., Gusti, R. D., Hasibuan, M. H. E., & Rusdi, M. (2020). The implementation of scaffolding in project-based learning to improve students' science process skills in buffer concept. *Jurnal Kimia Dan Pendidikan Kimia*, *5*(2).

Irsalina, A., & Dwiningsih, K. (2018). Analisis Kepraktisan Pengambangan Lembar Kegiatan Peserta Didik (LKPD) Berorientasi Blended Learning pada Materi Asam Basa. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *3*(3).

Jamilah, J., Sukitman, T., & Fauzi, M. (2021). Opportunities and Challenges of Digital Learning Media During the Covid-19 Pandemic in Primary School. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *11*(2). https://doi.org/10.30998/formatif.v11i2.9732

Masitoh, S. (2018). Blended Learning Berwawasan Literasi Digital Suatu Upaya Meningkatkan Kualitas Pembelajaran dan Membangun Generasi Emas 2045. *Proceedings of The ICECRS*, *1*(3). https://doi.org/10.21070/picecrs.v1i3.1377

Mufarohah, S. L., & Dwiningsih, K. (2018). The Effectiveness of Blended Learning Oriented LKS with POGIL Strategy on High School Chemical Bond Subject. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *3*(2). https://doi.org/10.20961/jkpk.v3i2.22328

Nada, E. I., & Sari, W. K. (2020). Digital Literacy Analysis of Chemistry Education Students in Using the ChemDraw Application. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *5*(3). https://doi.org/10.20961/jkpk.v5i3.46441

Nasir, M., Syarifuddin, S., & Rifa'i, A. (2022). Implementasi Blended Learning Pada Pembelajaran SKI MI Sebagai Penguatan Literasi Digital Mendesain E-Learning Berbasis Blogger Dan Google Form. *Al-Madrasah: Jurnal Pendidikan Madrasah Ibtidaiyah*, *6*(1). https://doi.org/10.35931/am.v6i1.874

Ningsih, E. L. C., & Jayanti, U. N. A. D. (2022). Discovery Blended Learning in Biology: Its

Effectiveness on Self-Efficacy and Student Learning Outcomes in the New Normal Era. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *12*(2). https://doi.org/10.30998/formatif.v12i2.13748

Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2020). Digital Literacy Test: Development of Multiple Choice Test for Preservice Physics Teachers. *International Journal of Advanced Science and Technology*, *29*(03).

Setiowati, H., Harahap, L. K., & Mardhiya, J. (2021). Implementation of The Video Project with Distance Learning on The Basic Chemistry Course. *JKPK (Jurnal Kimia Dan Pendidikan Kimia)*, *6*(2). https://doi.org/10.20961/jkpk.v6i2.52000