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Analysis of the Effect of PBL Model Assisted by e-Worksheet *Wizer.Me* on Critical Thinking Skills and Learning Outcomes of Physics Student

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ABSTRACT

Learning is a process to arrange and organize an environment that can grow and encourage students to learn. The critical thinking skills and academic achievements of students in Indonesia remain at a relatively low level. This diminished level of critical thinking skills and student learning outcomes is attributed to a lack of interest among students in the learning process.Appropriate learning models and media are very important in the learning process. The utilized research methodology is a true experiment with a quantitative approach. Data analysis was carried out using normality tests and statistical tests. Based on the normality test, the critical thinking ability data is normally distributed, so the data is continued with the T Test (Independent Sample T-Test) which results in an Asymp. Sig (2-tailed) of 0.000 is less than 0.05, so there is an effect of applying the PBL model assisted by E-LKPD wizer.me on the results of students' critical thinking skills on dynamic fluid material in high school. While the normality test of learning outcomes states that the data is not normally distributed, so data analysis is carried out with the Man Whitney U Test. Based on the Man Whitney U Test, the Asymp. Sig (2-tailed) of 0.000 is less than 0.05, so it can be concluded that there is an effect of the application of PBL model assisted by E-LKPD wizer.me on student learning outcomes on dynamic fluid material in high school. The conclusion of this study is that the application of the PBL model with the support of E-LKPD wizer.me has a significant effect on critical thinking skills in high school. Apart from that, the application of the PBL model assisted by E-LKPD wizer.me also has a significant influence on high school physics learning outcomes.

Keywords :PBL, E-LKPD, Wizer.we, Critical thinking, and learning outcomes.

I. INTRODUCTION

Learning is a process to organize and organize an environment that can grow and encourage students to learn. Physics learning studies about natural events and their interactions [1]. Physics is a field that is closely related between the modern world and current phenomena [2]. Therefore, physics learning is needed to help students understand physics and develop students' mindset that is closely related to everyday life.

Students in Indonesia have a level of critical thinking and learning achievement that is not yet optimal [3]. The critical thinking skills outcomes are still deficient, with 21% of students categorized as having moderate skills and 64% falling into the low skills category. In essence, it can be concluded that a considerable number of students lack proficient critical thinking abilities [4]. The problem of national education that must be addressed immediately is the ability to analyze critically and learning outcomes are quite low, so that the quality of education is not left behind from other countries. Appropriate learning models and media are very important in the learning process.

Based on interviews with physics teachers, it is revealed that almost all physics materials are implemented with PBL models using presentation, discussion and lecture methods. Books and blogs are still used by teachers to support the learning process. E-LKPD is also rarely used, resulting in less interesting learning process and

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lack of teacher and student interaction. Thus, there is a requirement for an effective learning model capable of fostering the development of students' critical thinking skills.

The learning model is a structured method employed in the educational process to attain predefined competencies [5]. Enhancing advanced cognitive abilities can be cultivated by honing problem-solving skills through the application of a problem-based learning approach [6]. Learning models are usually inseparable from learning media, such as E-LKPD as a support for learning activities. LKPD usually used in schools are printed LKPD, so they still have weaknesses in appearance and practicality [7]. Interactive E-LKPD can be accompanied by visuals such as images, videos, and animations to increase student understanding [8]. Interactive E-LKPD can be made with various software, one of which is by using the help of Wizer.me. Wizer.me is a website that can be accessed using smartphones and PC. Wizer.me has an attractive appearance, such as being able to choose a theme background, add videos, images, and audio[9].

The deficiency in critical thinking skills and student academic achievements arises from a lack of interest among students in the learning process. This aligns with the findings of research [10], which assert that the PBL model has the capability to enhance the critical thinking skills of students. In research [11], also produced results that the application of the PBL model affects students' critical thinking. The impact of the PBL model on enhancing problem-solving skills and student academic performance is notable, as indicated in research [12]. In addition, in research [13] titled "The Effectiveness of Using Wizer.me Interactive Media on Science Subjects in Class XI High School Students," it was found that the use of interactive learning media wizer.me can elevate student learning outcomes by placing students at the center of learning and fostering increased activity.

Based on the description of the problems about learning media that are less effective, interactive, and interesting, it is necessary to adjust the learning model. Learning will be implemented through the PBL learning model assisted by E-LKPD Wizer.me. Therefore, the author took the research title "Analysis Of The Effect Of PBL Model Assisted By E-LKPD *Wizer.me* On Critical Thinking Skills And Student Learning Outcomes Of High School Physics" to investigate the impact of implementing the Problem-Based Learning (PBL) model, aided by the E-LKPD Wizer.me, on students' critical thinking skills and their achievements in physics learning.

II. METHOD

The utilized research methodology is a true experiment with a quantitative approach. True experiment known as real experimental research is needed in determining the effect of a particular treatment [14]. The place of data collection was carried out at SMAN 3 Jember which was carried out, odd semester, class XI students in 2023/2024 in November 2023. The research was structured around a posttest-only control group design. Data gathering techniques included posttests, observations, interviews, and documentation. The posttest took place upon the conclusion of the learning phase and encompassed a critical thinking skills assessment with six questions, along with a learning outcomes evaluation comprising ten questions. The analysis of data involved the utilization of SPSS 27, encompassing homogeneity testing, normality testing, and statistical examination. The homogeneity test was executed to ascertain the assignment of the experimental and control classes. After that, a homogeneity test, normality test and statistical analysis were carried out. If the data follows a normal distribution, the analysis proceeds with the Independent Sample T Test; however, if the data does not exhibit normal distribution, the analysis shifts to the Mann Whitney U test.

III. RESULTS AND DISCUSSION

Data collection was carried out on November 6-16, 2023 at the State Senior High School 3 Jember. The study population consisted of four classes of XI MIPA. The population that has been determined, then continued the homogeneity test to identify the homogeneous level of the research population. The homogeneity test conducted with SPSS 27 yielded a significant value of $0.068 \geq 0.05$, indicating that the data exhibited a normal distribution. Cluster random sampling is employed to designate the experimental and control classes. After implementing this approach, the choice was made to designate XI-MIPA 3 as the experimental and XI-MIPA 4 as the control class. Teaching in the experimental class involved the implementation of a PBL model with assistance from the E-LKPD platform wizer.me. In contrast, the control class received instruction through traditional teaching methods, with the teacher using PPT media to deliver the learning material.

A. The effect of applying the PBL model assisted by E-LKPD wizer.me on students' critical thinking skills

The evaluation of critical thinking skills relies on the posttest data gathered from both the experimental and control class. The posttest was formulated in accordance with the critical thinking skill indicators defined by Facione. The assessment of critical thinking skills underwent a two-step procedure using SPSS 27, encompassing a normality test followed by a statistical test. The results of the normality test can be shown by table 1.

Table 1. Normality test of critical thinking ability

One-Sample Kolmogorov-Smirnov Test

			Critical Thinking Ability of Experimental Class	Critical Thinking Ability of Control Class
N			31	31
Normal Parameters[a,b]	Mean		82.55	70.45
	Std. Deviation		8.164	12.704
Most Extreme Differences	Absolute		.140	.143
	Positive		.123	.097
	Negative		-.140	-.143
Test Statistic			.140	.143
Asymp. Sig. (2-tailed)[c]			.125	.106
Monte Carlo Sig. (2-tailed)[d]	Sig.		.121	.105
	99% Confidence Interval	Lower Bound	.113	.097
		Upper Bound	.130	.113

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 957002199.

The Asymp. Sig (2-tailed) for the experimental class is 0.125, and for the control class, it is 0.106, surpassing the 0.05 threshold. Following the criteria for decision-making, a significance level (Sig) of ≥ 0.05 is indicative of normally distributed data, while Sig < 0.05 suggests non-normal distribution. Consequently, the critical thinking ability data in both classes is considered normally distributed. With the confirmation of normal distribution, the analysis proceeds to utilize the T Test (Independent Sample T-Test) for evaluating the data presented by Table 2.

Table 2: Independent Sample T-Test Results of Critical Thinking Ability

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Critical Thinking Ability	Equal variances assumed	6.184	.016	4.460	60	.000	12.097	2.712	6.671	17.522
	Equal variances not assumed			4.460	51.170	.000	12.097	2.712	6.652	17.541

The outcomes of the T Test (Independent Sample T-Test) reveal that the Asymp. Sig (2-tailed) is 0.000, indicating a significance level below 0.05. According to the decision criteria, when Sig < 0.05, H_0 is rejected, and Ha is accepted. This suggests that there is a difference in the average critical thinking skills of students between the experimental and control classes. As a result, it can be inferred that the adoption of the PBL model with the assistance of E-LKPD wizer.me has a noteworthy influence on the critical thinking skills of students, especially in grasping dynamic fluid material at the high school level.

Moreover, the critical thinking proficiency for each indicator in the experimental group exceeds that of the control group. The mean critical thinking ability for each indicator is visually depicted in Figure 1.

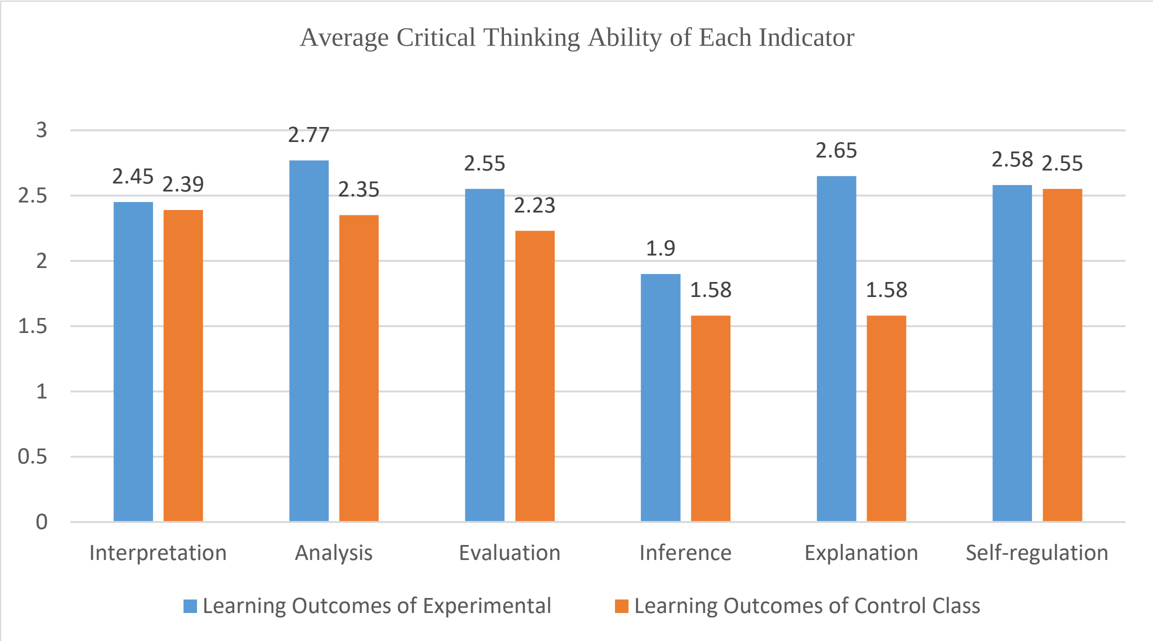

Figure 1. Graph of Average Critical Thinking Ability of Each Indicator

Comparing Figure 1 between the experimental and control classes, it is evident that the experimental class demonstrated an overall higher level of critical thinking skills. The analysis indicator achieved the highest average in the experimental group, whereas the self-regulation indicator had the highest average in the control class. Both the experimental and control class registered the lowest scores in the inference indicator. However, the experimental group demonstrated a higher average score in inference compared to the control group. The positive impact on students' critical thinking skills is attributed to the implementation of the PBL model with E-LKPD wizer.me. This approach enables students to independently solve problems through E-LKPD wizer.me, fostering autonomy in problem-solving and contributing to an improvement in critical thinking skills.

The PBL model is effective in cultivating critical and creative thinking among students during project work [15]. In this learning, students are empowered to independently resolve problems by identifying and implementing solutions. Utilizing student worksheets in conjunction with the PBL model fosters the development of problem-finding skills, as students are guided to investigate and analyze issues presented in the worksheets. This process enhances students' problem-solving abilities and contributes to the improvement of critical thinking skills, as students engage in the analysis, synthesis, and application of acquired concepts [16]. In research [17], using E-LKPD based on the problem-based learning model was noted to enhance critical thinking skills, evident in the higher N-gain results in critical thinking skills on the posttest in comparison to the pretest. The incorporation of the problem-based learning model, coupled with E-LKPD, improves the efficiency and effectiveness of the learning process, ultimately elevating students' critical thinking skills [18]. In research [19] The discovery was made that studying physics with LKPD is engaging, and the content is readily understandable, leading to an enhancement in critical thinking skills. The positive reception of E-LKPD by students further suggests that the incorporation of multimedia aids in facilitating a better understanding of the material [20]. Therefore, the adoption of a PBL model in physics education with the aid of E-LKPD wizer.me has the potential to enhance students' critical thinking skills.

B. The effect of applying PBL model assisted by E-LKPD wizer.me on students' physics learning outcomes

Data on students cognitive learning outcomes were obtained through a posttest of dynamic fluid learning outcomes consisting of ten questions. The learning outcomes measured in this study are indicators of cognitive learning outcomes C4-C6. The analysis of students' physics learning outcomes involved a two-stage process using SPSS 27, encompassing a normality test and a statistical test. The outcomes of the normality test for the data on learning outcomes can be observed in Table 3.

Table 3. Normality Test of Cognitive Learning Outcomes of Physics Students

One-Sample Kolmogorov-Smirnov Test

			Learning Outcomes of Experimental	Learning Outcomes of Control Class
N			31	31
Normal Parameters[a,b]	Mean		82.74	71.29
	Std. Deviation		9.560	10.163
Most Extreme Differences	Absolute		.206	.224
	Positive		.095	.196
	Negative		-.206	-.224
Test Statistic			.206	.224
Asymp. Sig. (2-tailed)[c]			.002	.000
Monte Carlo Sig. (2-tailed)[d]	Sig.		.002	.000
	99% Confidence Interval	Lower Bound	.001	.000
		Upper Bound	.003	.001

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. Lilliefors' method based on 10000 Monte Carlo samples with starting seed 624387341.

Reviewing Table 3, the Asymp. Sig (2-tailed) for the experimental group is 0.002, and for the control group, it is 0.000. Based on the decision-making criteria, data is considered normally distributed if Sig ≥ 0.05, whereas it is considered not normally distributed when Sig < 0.05. As a result, in this instance, the data is deemed to exhibit non-normal distribution. The data analysis employed the Mann-Whitney U test with the support of SPSS 27, given that the physics cognitive learning outcomes data did not conform to a normal distribution, and the findings are detailed in Table 4.

Table 4. Man Whitney U Test Results of Students' Coginitive Physics Learning Outcomes

Test Statistics[a]

	Student Learning Outcomes
Mann-Whitney U	191.000
Wilcoxon W	687.000
Z	-4.124
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Kelas

Referring to Table 4, the Asymp. Sig (2-tailed) value obtained is 0.000, which is less than 0.05. According to the decision-making criteria, when Sig < 0.05, H_0 is rejected, and Ha is accepted, indicating a significant difference in the average values of students' cognitive physics learning outcomes between both samples. Therefore, it can be concluded that introducing the PBL model with E-LKPD wizer.me noticeably influences the cognitive learning outcomes of students, specifically in the context of dynamic fluid material at the high school level. The graphical representation of the average cognitive learning outcomes of students is depicted in Figure 2.

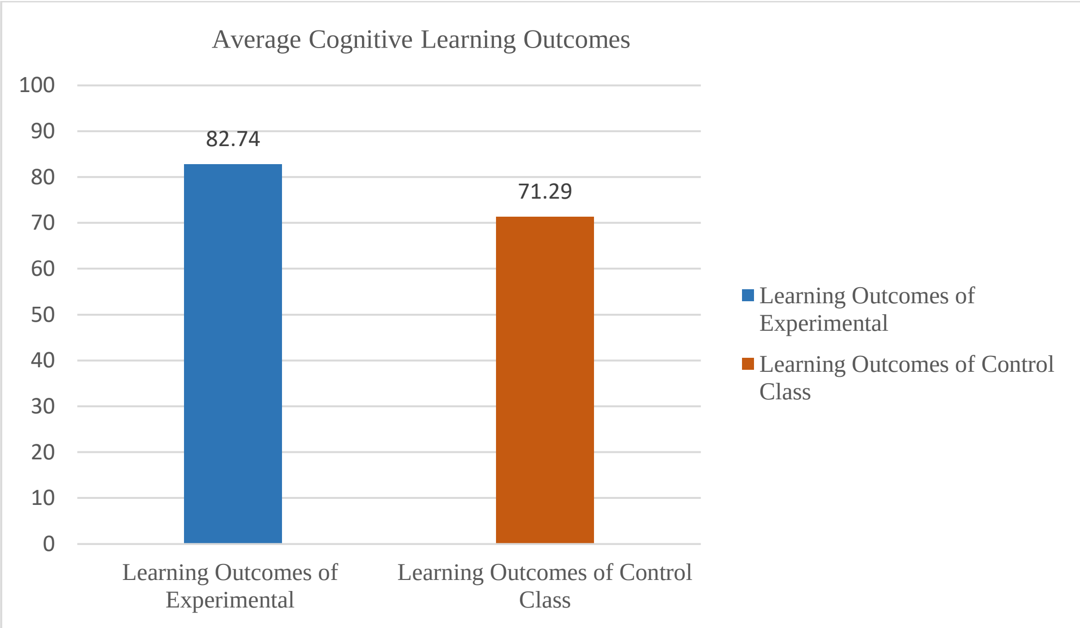

Figure 2. Graph of Average Cogintive Learning Outcomes

As illustrated in Figure 4.3, the average cognitive learning outcomes were 82.74 in the experimental class and 71.29 in the control class. The experimental class showed a higher average, signifying a substantial difference of 11.45. This implies that the implemented model has a considerable impact on the physics learning outcomes of students.

Learning in the experimental class is enhanced by the support of E-LKPD wizer.me, which emphasizes student engagement in problem-solving activities through initial problem presentations and practical sessions. This method plays a role in enhancing students' cognitive learning results, especially in the aspects of analysis, evaluation, and creation. Integrating wizer.me E-LKPD offers valuable information and presents questions that contribute to improving student learning outcomes, especially in the cognitive aspects of C4-C6. The integration of this technology also promotes student engagement and active involvement in the learning process, shifting away from a teacher-centered approach. The advantages of learning with E-LKPD extend to facilitating a better understanding of the subject matter and significantly influencing Higher Order Thinking Skills (HOTS) cognitive thinking skills [21]. These findings align with previous research conducted by [22], highlighting the beneficial effects of the PBL model, supported by platforms like wordwall.Net and E-LKPD wizer.me, on educational achievements. Additionally, [23] Confirms that implementing the PBL model contributes to enhanced student learning results. In another study [24] Additionally, it was mentioned that student worksheets can exert a substantial impact on students' physics learning outcomes. Consequently, it can be inferred that the utilization of the PBL model, supported by E-LKPD wizer.me, has a noteworthy influence on student learning outcomes in the context of dynamic fluid material at the high school level.

IV. CONCLUSION

Based on the research that has been conducted, it can be concluded that the application of the PBL model with the support of E-LKPD wizer.me has a significant effect on critical thinking skills in high school. Apart from that, the application of the PBL model assisted by E-LKPD wizer.me also has a significant influence on high school physics learning outcomes.

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REFERENCES

[1] D. A. S. Asih, “Pengaruh Penggunaan Fasilitas Belajar di Lingkungan Alam Sekitar Terhadap Keterampilan Proses Sains,” *Form. J. Ilm. Pendidik. MIPA*, vol. 7, no. 1, pp. 13–21, 2017, doi: 10.30998/formatif.v7i1.1331.

[2] D. Giancoli, *Fisika : Prinsip dan Aplikasi Edisi ke 7 Jilid 1*. Jakarta : Erlangga, 2014.

[3] M. D. Nuryanti, Lilis, Siti Zubaidah, “Analisis Kemampuan Berpikir Kritis Siswa SMP,” *J. Pendidik. Teor. Penelitian, dan Pengemb.*, vol. 3, no. 2, pp. 155–158, 2018.

[4] E. Susilawati, A. Agustinasari, A. Samsudin, and P. Siahaan, “Analisis Tingkat Keterampilan Berpikir Kritis Siswa SMA,” *J. Pendidik. Fis. dan Teknol.*, vol. 6, no. 1, pp. 11–16, 2020, doi: 10.29303/jpft.v6i1.1453.

[5] S. A. Octaviana, *Model - Model Pembelajaran*. Yogyakarta : Deepublish, 2020.

[6] A. A. Putri, I. W. Swatra, and I. M. Tegeh, “Pengaruh Model Pembelajaran Pbl Berbantuan Media Gambar Terhadap Hasil Belajar Ipa Siswa Kelas Iii Sd,” *Mimb. Ilmu*, vol. 23, no. 1, pp. 21–32, 2018, doi: 10.23887/mi.v23i1.16407.

[7] A. N. R. Indraswati, D., M. Sobri, A.Fauzi, L.W.Z.Amrullah, “Keefektifan Pelatihan Pembuatan Worksheet Interaktif dengan Wizer.Me untuk Mengoptimalkan Pembelajaran di SDN 26 Mataram,” *J. Educ.*, vol. 5, no. 4, pp. 14615–14624, 2023, Accessed: May 23, 2023.

[8] Indriani N. & Lazulva, “Desain dan Uji Coba LKPD Interaktif dengan Pendekatan Scaffolding pada Materi Hidrolisis Garam,” *J. Nat. Sci. Integr.*, vol. 3, no. 1, pp. 87–105, 2020, doi: 10.24014/jnsi.v3i1.9161.

[9] N. Kaliappen, W. N. A. Ismail, A. B. A. Ghani, and D. Sulisworo, “Wizer.Me and socrative as innovative teaching method tools: Integrating tpack and social learning theory,” *Int. J. Eval. Res. Educ.*, vol. 10, no. 3, pp. 1028–1037, 2021, doi: 10.11591/IJERE.V10I3.21744.

[10] H. H. Herzon, Budijanto, and D. Hari Utomo, “Pengaruh Problem-Based Learning (PBL) terhadap Keterampilan Berpikir Kritis,” *J. Pendidik.*, vol. 3, no. 1, pp. 42–46, 2018, [Online]. Available: http://journal.um.ac.id/index.php/jptpp/

[11] E. Yulianti and I. Gunawan, “Model Pembelajaran Problem Based Learning (PBL): Efeknya Terhadap Pemahaman Konsep dan Berpikir Kritis,” *Indones. J. Sci. Math. Educ.*, vol. 2, no. 3, pp. 399–408, 2019, doi: 10.24042/ijsme.v2i3.4366.

[12] A. Asiyah, A. Topano, and A. Walid, “Pengaruh Problem Based Learning (PBL) Terhadap Kemampuan Pemecahan Masalah Dan Hasil Belajar Kognitif Siswa SMA Negeri 10 Kota Bengkulu,” *Edukatif J. Ilmu Pendidik.*, vol. 3, no. 3, pp. 717–727, 2021,

[13] dan N. Idyawati, Indah, Nurdin, “Efektivitas Penggunaan Media Interaktif Wizer. Me Terhadap Mata Pelajaran IPA Pada Siswa Kelas XI SMA,” *J. Pendidik. dan Pembelajaran*, vol. 2, no. 2, pp. 105–118, 2022.

[14] Sugiyono, *Metode Penelitian Kuantitatif Kualitatif dan R&D*. Yogyakarta : ALFABETA, 2020.

[15] R. D. Yance, E. Ramli, and F. Mufit, “Pengaruh Penerapan Model Project Based Learning (Pbl) Terhadap Hasil Belajar Fisika Siswa Kelas Xi Ipa Sma Negeri 1 Batipuh Kabupaten Tanah Datar,” vol. 1, no. April, pp. 48–54, 2013.

[16] A. Aprilia, Y. Darvina, M. Murtiani, and W. S. Dewi, “the Effect From Application of Student Worksheet Based on Problem Solving in Achieving Student’S Critical Thinking Skills on Kinetic Theory of Gases and Thermodynamics,” *Pillar Phys. Educ.*, vol. 15, no. 1, p. 57, 2022, doi: 10.24036/12681171074.

[17] V. Yulanda, A. Hamidah, and E. Anggereini, “Pengembangan Lembar Kerja Peserta didik Elektronik (E-LKPD) Berbasis Problem Based Learning Sebagai Upaya Meningkatkan Kemampuan Berpikir Kritis SiswaKelas VIII pada Materi Sistem Pernafasan,” in *Prosiding SNPS (seminar Nasional Pendidikan Sains)*, 2023, pp. 62–69.

[18] R. M. Ayirahma and M. Muchlis, “Pengembangan E-LKPD berorientasi model PBL untuk meningkatkan keterampilan berpikir kritis pada materi asam basa,” *J. Pendidik. Indones.*, vol. 4, no. 6, pp. 675–683, 2023, doi: 10.59141/japendi.v4i6.1961.

[19] A. N. Hamidy and L. Nuraini, “Pengaruh Metode Praktikum terhadap Keterampilan Berpikir Kritis Siswa pada Materi Pengukuran di SMAN 5 Jember,” *J. Penelit. Pendidik. Fis.*, vol. 8, no. 3, pp. 186–195, 2023.

[20] S. S. Choiroh, S. H. Budi Prastowo, and L. Nuraini, “Identifikasi Respon Peserta Didik Terhadap E-Lkpd Interaktif Fisika Berbantuan Live Worksheets Pokok Bahasan Pengukuran,” *J. Pembelajaran Fis.*, vol. 11, no. 4, p. 144, 2023, doi: 10.19184/jpf.v11i4.34891.

[21] S. S. Choiroh, S. H. B. Prastowo, and L. Nuraini, “Pengaruh Penggunaan E-LKPD Interaktif Berbantuan Live Worksheets terhadap Kemampuan Berpikir Kognitif HOTS Fisika Siswa SMA,” *J. Ilm. Pendidik. Fis.*, vol. 6, no. 3, p. 694, 2022, doi: 10.20527/jipf.v6i3.6795.

[22] L. B. Subagja, “Pengaruh Model Pembelajaran Problem Based Learning (PBL) Berbantuan Aplikasi Berbasis Website Wordwall . Net Dan e -LKPD Wizer . Me Terhadap Motivasi Belajar Siswa,” *J. Inov. Pendidik. Mat.*, vol. 3, no. 2, pp. 141–150, 2022.

[23] A. Rahmi, Y. W. Fitri, F. Zahara, and D. Desnita, “Meta analisis pengaruh model pembelajaran problem based learning (PBL) terhadap hasil belajar fisika,” *J. Pendidik. Fis. Undiksha*, vol. 11, no. 2, pp. 11–18, 2021.

[24] A. Mauliya, I. Ketut Mahardika, and R. Ridlo, “Krajan Timur, Sumbersari, Kec. Sumbersari, Jember, 68121, Indonesia 2 Physical Education Study Program,” *Kraj. Timur, Sumbersari, Kec. Sumbersari, Jember*, vol. 113, no. 37, pp. 113–119, 2023.