

IMPROVING EDITORIAL TEXT WRITING ABILITY THROUGH PROBLEM BASED LEARNING METHODS IN HIGH SCHOOL STUDENTS

Nurdahlia ^{a*)}, Esti Swatika Sari ^{a)'}

^{a)} Universitas Negeri Yogyakarta, Indonesia

^{*)}Corresponding Author: nurdahlia.2022@student.uny.ac.id

Article history: received 21 April 2025; revised 02 May 2025; accepted 02 June 2025

DOI: <https://doi.org/10.33751/jhss.v9i1.12098>

Abstract. This study aims to find out the improvement the learning process of writing students' editorial texts using the problem-based learning method and the results of students' ability to write editorial texts using the problem-based learning method of class XII-MIA SMAN 2 Tana Tidung. This research is a classroom action research. The subject of this class action research is class XII-MIA students of SMA Negeri 2 Tanah Tidung which totals 30 people, consisting of 7 male students and 23 female students. The research was carried out in two cycles consisting of four stages of each cycle, namely planning, implementation of actions, observation, and reflection. The data collection techniques used in this study are in the form of questionnaires, observations, interviews, field notes, photo documentation, and writing assessment sheets. The data obtained were analyzed in a qualitative descriptive manner supported by quantitative data. The results of the study: (1) there was an increase in the learning process using the problem based learning method in writing editorial texts for students of class XII-MIA SMAN 2 Tana Tidung which was shown by activeness, attention to lessons, enthusiasm, courage to appear in front of the class, and group cooperation so as to create a fun, active, and creative learning atmosphere, (2) an increase in the ability to write editorial texts using the problem based learning. The ability to write editorial text in the pre-action stage gets an average score of 49. In the first cycle, the average score was 75, and the second cycle obtained an average score of 86.

Keywords: writing ability; problem based learning; language learning

I. INTRODUCTION

Editorial text writing skills are one of the important abilities that need to be mastered by students at the high school education level. Editorial texts not only train students to express opinions in writing, but also encourage them to think critically and logically in analyzing emerging issues (Saripudin et al., 2021). In writing editorial texts, students are required to develop strong arguments, present facts objectively, and be able to convince readers through clear and structured points of view. This skill is especially important in today's information age, where the ability to think critically and the ability to construct logical arguments are part of the literacy necessary to understand various social, political, and cultural phenomena (Huang et al., 2019); Hariyadi et al., 2023; Oktarina et al., 2021; Rahman et al., 2023; Santosa et al., 2022; Zulyusri et al., 2023).

The ability to write editorial texts also has a positive impact on the development of students' communication competencies (Hmelo & Silver 2004). Through the writing process, students learn how to convey ideas in effective and persuasive language, which focuses not only on conveying ideas, but also on how to present them so that they can be accepted by a wide audience (Bulqiyah et al., 2021). This is important, especially in preparing students for future academic and professional life, where writing and critical thinking skills are the main provisions (Awada et al., 2019). Thus, writing

editorial texts is an effective means of training students to develop reflective and creative thinking skills, as well as improve their academic literacy (Ayunda et al., 2024; Syafruddin et al., 2024; Zulkifli et al., 2022).

Writing editorial texts requires students to have the ability to think critically, but this is often the main challenge they face. Many students have difficulty analyzing complex issues in depth and objectively, which is an important foundation in editorial writing (Munajah et al., 2023). The ability to see a problem from multiple perspectives, assess the validity of information, and draw logical conclusions is not optimally developed in most students. In addition, many of them are still used to receiving information passively without being trained to process it critically (Pateda et al., 2024). As a result, they tend to have difficulty when asked to craft a strong and convincing argument in an editorial text. Another challenge lies in the preparation of arguments and language skills (Hao & Razali, 2022). Writing an editorial text requires not only clear ideas, but also the ability to string arguments in a coherent and logical manner. Many students have difficulty constructing coherent arguments because they are not skilled in designing a systematic flow of thought. Limitations in mastering the right vocabulary and appropriate language style also often make them unable to convey ideas effectively (Hao & Razali, 2022). Weak language skills, both in grammar and writing style, can

reduce the clarity and persuasiveness of the written editorial text. These challenges show that more comprehensive and effective learning strategies are needed to help students overcome obstacles in writing editorial texts (Ali et al., 2024.; Edy Nurtamam et al., 2023; Ichsan et al., 2023).

Conventional learning methods that are often used in schools tend to focus on one-way knowledge transfer from teacher to student, so it does not support the development of more complex writing skills, such as writing editorial texts (Charlina et al., 2022). In this method, teachers usually provide more theory and basic rules of writing without giving enough space for students to be actively involved in the process of critical and creative thinking (Widiana et al., 2024). As a result, students often simply follow instructions without really understanding how to build a strong argument or structure an idea logically. This less interactive conventional learning approach also makes students rarely get the opportunity to discuss or solve problems collaboratively, even though this ability is indispensable in writing editorial texts that require a broad perspective and in-depth analysis.

Furthermore, traditional learning methods often do not provide in-depth feedback regarding the student's writing process. Learning tends to focus on the end result, such as an assessment of grammar or sentence structure, without paying enough attention to the student's thought process when composing arguments (Daryanes et al., 2023). The lack of opportunities to revise and improve writing based on constructive input is also one of the factors that hinder the development of students' writing skills. This causes students to be unaccustomed to honing their writing skills on an ongoing basis and are unable to develop the language skills necessary to write effective editorial texts (Bulqiyah et al., 2021). In this context, conventional learning methods are less optimal in preparing students to be able to write quality editorial texts. Therefore, there is a need for a learning model that effectively improves students' writing skills, one of which is through the project-based learning method (Munajah et al. 2023; Charlina et al. 2022).

Problem Based Learning (PBL) is an effective learning approach in improving students' writing skills, especially in the context of editorial text writing (Mustafa et al., 2019); Lestari et al., 2024). PBL places students at the centre of the learning process, where they are faced with real problems that must be solved through critical thinking, in-depth analysis and collaboration (Prasetyo et al., 2024). In editorial text writing, this approach is very relevant as it encourages students to explore actual issues and develop arguments based on data and logical analysis. The problem-solving process in PBL provides opportunities for students to actively formulate ideas, evaluate information, and build strong arguments, which are key elements in writing effective editorials (Chaidam and Poonputta 2022; Nanda et al. 2023). In addition, PBL helps students develop language skills through group discussion and reflection on the problems they face. By engaging in a contextualised learning process, students not only learn to write by following the rules of grammar and text structure, but also exercise their ability to organise ideas systematically. PBL also allows students to receive immediate feedback from teachers

and classmates during the problem-solving process, so that they can improve their writing gradually (Sukontawaree et al., 2022). This approach provides an environment that supports active and continuous learning, which is proven to be more effective in improving editorial writing skills compared to conventional learning methods.

Research conducted by Duch et al. (2019), PBL encourages students to be more critical in analysing problems and finding solutions based on relevant evidence. The study found that students who engaged in PBL had a significant improvement in the ability to construct arguments and develop a logical train of thought, two very important aspects in writing editorial texts. Another study by Barrows & Tamblyn (2023) confirmed that PBL provides a more in-depth learning experience because students are exposed to situations that resemble the real world, so they are more involved in the learning process and can apply the concepts they learn in a practical context. research conducted by Sungur & Tekkaya (2016) found that PBL not only improves academic skills but also students' communication and collaboration skills. In the context of writing editorial texts, these skills are indispensable as students need to be able to convey their arguments clearly and convincingly, as well as work together in groups to develop more complex ideas. Based on this, this study aims to determine the improvement of students' editorial text writing learning process by using a problem-based learning method.

II. RESEARCH METHODS

This research is a type of class action research. The subjects of this class action research were 30 students of class XII-MIA SMA Negeri 2 Tana Tidung, consisting of 7 male students and 23 female students. The research was conducted in two cycles consisting of four stages each cycle, namely planning, action implementation, observation, and reflection. Data collection techniques used in this study were questionnaires, observations, interviews, field notes, photo documentation, and writing assessment sheets. The data obtained were analysed descriptively qualitatively supported by quantitative data.

III. RESULT AND DISCUSSION

Based on the results of the research from the pre-action activities, students' ability to write texts before taking action will be presented in table 1.

Table 1. Editorial Text Writing Ability Assessment Score for Class XII-MIA Pre-Action Stage

No.	Aspects	Pre-Action Average	Category
1.	Write content by title	73	C
2.	Organize the text according to the structure	59	C
3.	Using rhetorical sentences	34	K
4.	Provides argument reinforcement	38	K
5.	Using conjunctions in text	43	K
Total		247	

Based on Table 1, Writing the content based on the title In this aspect, students get an average score of 73, which falls

into the Fair (C) category. This shows that in general, students have been able to write the content of the text that is relevant to the given title, although there is still room for improvement in composing content that is more in-depth and optimally related to the topic. Composing the text according to the structure The average score for this aspect is 59, also in the Fair (C) category. This indicates that students understand the importance of structure in editorial texts, but their ability to compose texts with an appropriate structure still needs to be improved, especially in terms of the harmony between the argument, introduction, and conclusion. Using rhetorical sentences in this aspect, the average score obtained is 34, which falls into the Less (K) category. This shows that students still have difficulties in using appropriate rhetorical sentences to convince or influence readers in editorial texts. Rhetorical sentences are important to give strength to arguments, but their use is still very limited at this pre-action stage. The average score for this aspect is 38, which also falls into the Less (K) category. This means that students have not been optimal in providing reinforcement to the arguments presented, so the text written is still less convincing and not sufficiently supported by strong evidence or logical reasons. Furthermore, the aspect of Using conjunctions in the text The average score obtained by students for this aspect is 43, which falls into the category of Less (K). This indicates that students' ability to use conjunctions in the text is still weak, even though conjunctions are important to build connections between sentences and paragraphs to make the writing more cohesive.

Furthermore, the application of this method can help improve students' ability to write editorial texts even in cycle 1 which can be seen in Graph 1.

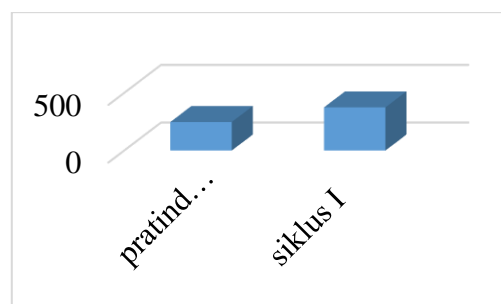


Figure 1. Improvement of Students' Editorial Text Writing Ability from Pre-Action to Cycle 1

Based on Graph 1, it can be concluded that students' editorial text writing skills have increased, which in the pre-action obtained a total score of 247 increased to 374 in cycle 1. The increase in each aspect of editorial text writing assessment starts from the aspect that has the highest increase to the lowest, namely the aspect of composing text with the right structure, adding supporting arguments, using conjunctions appropriately, writing content based on the title, using rhetorical sentences. The improvement in some of these aspects is inseparable from the role of the problem-based learning method which can encourage students to improve their writing skills. Furthermore, the Average Writing Score of Each Writing Aspect of Cycle II is presented in Table 2.

Table 3. Exposure to the Average Writing Score of Each Aspect of Writing Cycle II

No.	Aspects	Average Score
1.	Suitability of content with the title	95
2.	Accuracy of text structure	85
3.	Correctness of the use of rhetorical sentences	78
4.	Argument reinforcement	75
5.	Correctness of use of conjunctions	74

Based on Table 3, the results of observations made in cycle II have also shown a fairly good change process. This can be seen in the quality of learning. Students are more punctual in completing their assignments, more focused and serious attention and more effective. Students' attention has been focused on the learning needs in the classroom. Writing activities become more meaningful and give rise to a good sense of confidence in their work. Students' cognitive ability/reflection of the results in cycle II, the teacher carried out an evaluation at the end of learning. A detailed recap of the values in cycle II can be seen in table 3.

Table 3. Classification of Cycle II Values

No.	Value	Mastery Level	Percentage	Percentage
1.	86 – 100	Excellent	7%	Completed
2.	75 – 85	Good	86%	
3.	56 – 74	Enough	7%	No Completed
4.	30 – 55	Less		
5.	<30	Very Less		

Based on Table 3, students who achieved a sufficient level of mastery were 7%, a good mastery level of 86%, and a very good mastery level of 7%. This means that the score results with a total of 30 students are said to have reached a classical completeness level of $\geq 76\%$, namely the ability to write editorial texts, it appears that 93% of students have reached the criteria for research success. Therefore, the application of the problem-based learning method has been proven to improve students' ability to write editorial texts. Problem-Based Learning (PBL) has proven to be effective in improving students' ability to write editorial texts. This is due to the characteristics of PBL that place students as active subjects in the learning process, where they are faced with real problems that require critical solving. In this study, students are invited to analyze current social issues, which are relevant to their lives, thus encouraging them to think more deeply and reflectively (Qondias et al., 2022). This process not only assists students in understanding the structure of the editorial text, but also strengthens their ability to construct clear and convincing arguments. One of the main aspects that is focused on improving writing skills through the PBL method is the preparation of text structure (Prasetyo et al., 2024). The results of the study showed a significant increase in students' ability to compose editorial texts according to the correct structure, which consisted of an introduction, body, and conclusion (Şaşmaz & Çifci, 2023). In the PBL process, students are not

only given the freedom to explore their ideas, but are also guided to follow a logical flow of thought (Lestari et al. 2024; Siagian et al., 2019). With teacher guidance and group discussions, students learn how to structure opinions and evidence in a structured manner, so that the resulting text becomes more systematic and easy to understand (Erbasan & Dedeoğlu, 2023);

This study also revealed that the use of rhetorical sentences has increased along with the application of the PBL method. Rhetorical sentences are very important in editorial texts because they are able to reinforce arguments and influence readers emotionally and intellectually (Nanda et al., 2023). In the application of PBL, students are invited to sharpen their critical thinking skills through discussion and reflection, which ultimately contributes to their ability to compose more effective rhetorical sentences. The use of rhetorical sentences is no longer just a decoration in the text, but a tool that can strengthen the arguments posed (Aristin et al., 2023). One of the strengths of the PBL method is the ability to reinforce arguments through group discussion and collaboration. In this study, students were assigned to work in small groups, where they discussed various viewpoints related to a given topic (Arifin et al. 2020; Amin et al. 2020). This discussion process allows students to test the validity of their arguments and get input from their classmates, so that the arguments they construct become stronger and more directed. In addition, this collaboration also helps students to understand the importance of supporting arguments with relevant data or evidence, which is an important element in writing editorial text (Yang et al., 2024; Wanglang & Chatwattana, 2023).

The PBL method has also been proven to be effective in increasing the use of conjunctions and cohesion between sentences in editorial texts. One of the difficulties that students often face in writing is the lack of ability to connect ideas with each other seamlessly (Utomo et al., 2023). In this study, the application of PBL allows students to better understand the function of conjunctions in building text cohesion (Qondias et al., 2022). Group discussions and revision processes carried out in PBL learning help students realize the importance of the connection between sentences and paragraphs, so that they can compose a more coherent and well-structured text (Nurlaily et al., 2019). The application of the Problem Based Learning (PBL) method has a significant impact on improving students' ability to write editorial texts. In addition to improvements in text structure, rhetorical sentences, arguments, and the use of conjunctions, this method also encourages students to be more independent and critical in the writing process. This finding has important implications for the world of education, especially in learning to write in high school (Saripudin et al., 2021). Teachers are expected to be able to integrate the PBL method in the learning process, because it has been proven to be able to overcome weaknesses that are often found in conventional learning methods. With the right implementation, PBL can be an effective strategy to improve the quality of student writing, especially in writing editorial texts.

IV. CONCLUSIONS

From the results of this study, it can be concluded that there is an increase in the learning process using *the problem-based learning* method in writing editorial texts for students of class XII-MIA SMAN 2 Tana Tidung which is shown by activeness, attention to lessons, enthusiasm, courage to appear in front of the class, and group cooperation so as to create a fun, active, and creative learning atmosphere, and an increase in the results of editorial text writing skills with using *the problem based learning method*. The ability to write editorial text in the pre-action stage gets an average score of 49. The first cycle showed an average score of 75, and the second cycle obtained an average score of 86.

REFERENCES

- [1] Ali, M., Nurhayati, R., Wantu, H. M., Amri, M., & Santosa, T. A. (n.d.). The Effectiveness of Jigsaw Model Based on Flipped Classroom to Improve Students' Critical Thinking Ability in Islamic Religious Education Learning.
- [2] AmiN, S., Utaya, S., Bachri, S., Sumarmi, S., & SusiLo, S. (2020). Effect of Problem Based Learning on Critical Thinking Skill and Environmental Attitude. *Journal for the Education of Gifted Young Scientists*, 8(2), 743–755. <https://doi.org/10.17478/jegys.650344>
- [3] Arifin, S., Setyosari, P., Sa'dijah, C., & Kuswandi, D. (2020). The effect of problem based learning by cognitive style on critical thinking skills and student retention. *Journal of Technology and Science Education*, 10(2), 271. <https://doi.org/10.3926/jotse.790>
- [4] Aristin, N. F., Hastuti, K. P., Arisanty, D., Adyatma, S., & Donna, C. (2023). Effectiveness of problem-based learning models to improve learning outcomes of geography in the new normal learning era. *Journal of Education and Learning (EduLearn)*, 17(4), 623–632. <https://doi.org/10.11591/edulearn.v17i4.20834>
- [5] Awada, G., Burston, J., & Ghannage, R. (2019). Effect of student team achievement division through WebQuest on EFL students' argumentative writing skills and their instructors' perceptions. *Computer Assisted Language Learning*, 33, 1–26. <https://doi.org/10.1080/09588221.2018.1558254>
- [6] Ayunda, A. D., Hasanah, H., & Ariyanti, N. A. (2024). Development of a flipped classroom-based e-module to improve problem-solving abilities and learning independence of high school students. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 10(2), 453–466. <https://doi.org/10.22219/jpbi.v10i2.32183>
- [7] Bulqiyah, S., Mahbub, Moh. A., & Nugraheni, D. A. (2021). Investigating writing difficulties in essay writing: Tertiary students' perspectives. *English Language Teaching Educational Journal*, 4(1), 61. <https://doi.org/10.12928/eltej.v4i1.2371>
- [8] Chaidam, O., & Poonputta, A. (2022). Learning Achievement Improvement of 1st Grade Students by Using Problem-Based Learning (PBL) on TPACK

- MODEL. *Journal of Education and Learning*, 11(2), 43. <https://doi.org/10.5539/jel.v11n2p43>
- [9] Charlina, C., Septyanti, E., Mustika, T. P., & Rahmi, A. (2022). Electronic module as learning needs to write exposition texts for junior high school students. *Journal of Education and Learning (EduLearn)*, 16(2), 219–225. <https://doi.org/10.11591/edulearn.v16i2.20402>
- [10] Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, 9(4), e15082. <https://doi.org/10.1016/j.heliyon.2023.e15082>
- [11] Edy Nurtamam, M., Santosa, T., Ilwandri, Aprilisia, S., Rahman, A., & Suharyat, Y. (2023). Meta-analysis: The Effectiveness of Iot-Based Flipped Learning to Improve Students' Problem Solving Abilities. *Edumaspul - Jurnal Pendidikan*, 7, 1491–1501. <https://doi.org/10.33487/edumaspul.v7i1.6195>
- [12] Erbasan, Ö., & Dedeoğlu, H. (2023). Developing Informational Text Writing Skills of Gifted Students by Leveraging Writing Strategies. *Kuramsal Eğitim*, 16(3), 641–673. <https://doi.org/10.30831/akukeg.1257444>
- [13] Hao, H., & Razali, A. B. (2022). The Impact of Peer Feedback on Chinese EFL Junior High School Students' Writing Performance. *English Language Teaching*, 15(9), 9. <https://doi.org/10.5539/elt.v15n9p9>
- [14] Hariyadi, S., Rofi'i, A., Santosa, T. A., Taqiyuddin, & Sakti, B. P. (2023). Effectiveness of STEM-Based Mind Mapping Learning Model to Improve Students' Science Literacy in the Era of Revolution 4.0. *Jurnal Penelitian Pendidikan IPA*, 9(10), 791–799. <https://doi.org/10.29303/jppipa.v9i10.5125>
- [15] Hmelo-Silver, C. E. (2004). Problem-Based Learning: What and How Do Students Learn? *Educational Psychology Review*, 16(3), 235–266. <https://doi.org/10.1023/B:EDPR.0000034022.16470.f3>
- [16] Huang, H., Hwang, G.-J., & Chang, C.-Y. (2019). Learning to be a writer: A spherical video-based virtual reality approach to supporting descriptive article writing in high school Chinese courses. *British Journal of Educational Technology*, 51. <https://doi.org/10.1111/bjet.12893>
- [17] Ichsan, I., Suharyat, Y., Santosa, T. A., & Satria, E. (2023). Effectiveness of STEM-Based Learning in Teaching 21 st Century Skills in Generation Z Student in Science Learning: A Meta-Analysis. *Jurnal Penelitian Pendidikan IPA*, 9(1), 150–166. <https://doi.org/10.29303/jppipa.v9i1.2517>
- [18] Lestari, P. D., Baiduri, B., & Ummah, S. K. (2024). Problem-based learning with iSpring assisted inquiry method on critical thinking skills. *Journal of Education and Learning (EduLearn)*, 18(1), 148–153. <https://doi.org/10.11591/edulearn.v18i1.21089>
- [19] Munajah, R., Sumantri, M. S., & Yufiarti, Y. (2023). Teachers' perceptions on the need to use digital storytelling based on local wisdom to improve writing skills. *South African Journal of Childhood Education*, 13(1). <https://doi.org/10.4102/sajce.v13i1.1314>
- [20] Mustafa, S., Sari, V., & Baharullah, B. (2019). The Implementation of Mathematical Problem-Based Learning Model as an Effort to Understand the High School Students' Mathematical Thinking Ability. *International Education Studies*, 12(2), 117. <https://doi.org/10.5539/ies.v12n2p117>
- [21] Nanda, A. D., Hasan, R., Sukri, A., Lukitasari, M., & Rivera, A. T. (2023). Reinforcement analyze and evaluate of higher-order thinking skills using problem-based learning in ecosystem material. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 9(3), 492–499. <https://doi.org/10.22219/jpbi.v9i3.28604>
- [22] Nurlaily, V. A., Soegiyanto, H., & Usodo, B. (2019). ELEMENTARY SCHOOL TEACHER'S OBSTACLES IN THE IMPLEMENTATION OF PROBLEM-BASED LEARNING MODEL IN MATHEMATICS LEARNING. *Journal on Mathematics Education*, 10(2), 229–238. <https://doi.org/10.22342/jme.10.2.5386.229-238>
- [23] Oktarina, K., Santosa, T. A., Razak, A., Ahda, Y., & Putri, D. H. (2021). Meta-Analysis: The Effectiveness of Using Blended Learning on Multiple Intelligences and Student Character Education during the Covid-19 Period. 4(3).
- [24] Pateda, L., Saleh, Y. R., Pido, N. W. T., Adam, S., & Wantu, H. M. (n.d.). The Effect of an Augmented Reality-Based Discovery Learning Model on Students' Language Proficiency: A Meta-Analysis.
- [25] Prasetyo, P., Al Muhdhar, M. H. I., Ibrohim, I., & Saptasari, M. (2024). Promoting students' environmental literacy through PBIB learning model. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 10(2), 383–391. <https://doi.org/10.22219/jpbi.v10i2.33034>
- [26] Qondias, D., Lasmawan, W., Dantes, N., & Arnyana, I. B. P. (2022). Effectiveness of Multicultural Problem-Based Learning Models in Improving Social Attitudes and Critical Thinking Skills of Elementary School Students in Thematic Instruction. *Journal of Education and E-Learning Research*, 9(2), 62–70. <https://doi.org/10.20448/jeelr.v9i2.3812>
- [27] Rahman, A. A., Santosa, T. A., Nurtamam, M. E., Widoyo, H., & Rahman, A. (2023). Meta-Analysis: The Effect of Ethnoscience-Based Project Based Learning Model on Students' Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 9(9), 611–620. <https://doi.org/10.29303/jppipa.v9i9.4871>
- [28] Santosa, T. A., Suhaimi, S., & Aprilisia, S. (2022). Analisis Pendekatan Saintifik Dalam Pembelajaran IPA Selama Pandemi Covid-19 di Sekolah Dasar. *Jurnal DIDIKA: Wahana Ilmiah Pendidikan Dasar*, 8(1), Article 1. <https://doi.org/10.29408/didika.v8i1.5776>
- [29] Saripudin, D., Fauzi, W. I., & Nugraha, E. (2021). The Development of Interactive E-Book of Local History for Senior High School in Improving Local Wisdom and Digital Literacy. *European Journal of Educational Research*, volume-11–2022(volume-11–issue-1–

- january–2022), 17–31. <https://doi.org/10.12973/eu-jer.11.1.17>
- [30] Şaşmaz, E., & Çifci, S. (2023). Expert Opinions on Improving Informative Text Writing Skills Through Descriptive Writing Practices. *International Journal of Education and Literacy Studies*, 11(1), 50–58. <https://doi.org/10.7575/aiac.ijels.v.11n.1p.50>
- [31] Siagian, M. V., Saragih, S., & Sinaga, B. (2019). Development of Learning Materials Oriented on Problem-Based Learning Model to Improve Students' Mathematical Problem Solving Ability and Metacognition Ability. *International Electronic Journal of Mathematics Education*, 14(2). <https://doi.org/10.29333/iejme/5717>
- [32] Sukontawaree, N., Poonputta, A., & Prasitnok, O. (2022). Development of Problem-Solving Abilities in Science by Inquiry-Based Learning With Cooperative Learning for Grade 4 Students. *Journal of Educational Issues*, 8(2), 771. <https://doi.org/10.5296/jei.v8i2.20418>
- [33] Syafruddin, S., Wantu, H. M., Muis, A., Sarnoto, A. Z., Hiola, S. F., Agustina, I., Santosa, T. A., Yastanti, U., Nugraha, A. R., Dewanto, D., Solissa, E. M., Sukini, S., Wulandary, A. S. R., Ali, M., & Kurniawan, A. (2024). Effectiveness of Think-Pair-Share and STEM Models on Critical Thinking in Early Childhood Education. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, 8(5), 1320–1330. <https://doi.org/10.31004/obsesi.v8i5.6202>
- [34] Utomo, W., Suryono, W., Jimmi, J., Santosa, T. A., & Agustina, I. (2023). Effect of STEAM-Based Hybrid Based Learning Model on Students' Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 9(9), 742–750. <https://doi.org/10.29303/jppipa.v9i9.5147>
- [35] Wanglang, C., & Chatwattana, P. (2023). The Project-Based Learning Model Using Gamification to Enhance 21st Century Learners in Thailand. *Journal of Education and Learning*, 12(2), 99. <https://doi.org/10.5539/jel.v12n2p99>
- [36] Widiana, L. V. W., Prayitno, B. A., & Sugiharto, B. (2024). Framework problem solving based augmented reality media to empower scientific explanation skill. *JPBI (Jurnal Pendidikan Biologi Indonesia)*, 10(2), 631–639. <https://doi.org/10.22219/jpbi.v10i2.32387>
- [37] Yang, H., Zhang, Q., & Shen, M. (2024). The Practice and Research of Junior High School Information Technology Project-Based Learning Based on STEM Education Concept. *International Journal of Technology in Education and Science*, 8(1), 63–74. <https://doi.org/10.46328/ijtes.537>
- [38] Zulkifli, Z., Satria, E., Supriyadi, A., & Santosa, T. A. (2022). Meta-analysis: The effectiveness of the integrated STEM technology pedagogical content knowledge learning model on the 21st century skills of high school students in the science department. *Psychology, Evaluation, and Technology in Educational Research*, 5(1), Article 1. <https://doi.org/10.33292/petier.v5i1.144>
- [39] Zulyusri, Z., Elfira, I., Lufri, L., & Santosa, T. A. (2023). Literature Study: Utilization of the PjBL Model in Science Education to Improve Creativity and Critical Thinking Skills. *Jurnal Penelitian Pendidikan IPA*, 9(1), 133–143. <https://doi.org/10.29303/jppipa.v9i1.2555>