

Correlation Between the Phases of Tuberculosis Treatment and Depression Levels

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Abstract: Tuberculosis (TB) is an infectious disease that remains a global health problem, including in Indonesia. In addition to the physical impact, pulmonary TB patients are also susceptible to psychological disorders such as depression, which may arise due to concerns about symptoms and treatment. Depression ranks first among mental health disorders in Indonesia. This study aims to determine the correlation between the phases of TB treatment and depression levels in pulmonary TB patients. This study employed an analytical observational design with a cross-sectional approach and used consecutive sampling. Data were collected from February 17 to June 8, 2024, using the Beck Depression Inventory-II (BDI-II) questionnaire. A total of 38 pulmonary TB patients participated in this study with 6 experiencing depression of varying severity. Spearman correlation test showed no statistically significant association between the phases of TB treatment and depression levels ($p = 0.093$). Based on these results, it can be concluded that there is no significant correlation between the phases of TB treatment and depression levels in pulmonary TB patients at Puskesmas Putat Jaya, Surabaya.

Keywords: Beck depression inventory-II; Depression; Tuberculosis; Treatment phases

Introduction

Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis*, which affects the lung parenchyma or extra pulmonary organs and can be transmitted through airborne droplet nuclei released when a patient with TB coughs, sneezes, or talks (Arsyad et al., 2024; Sihombing et al., 2025; Swalehe & Obeagu, 2024). Globally, TB ranks as the second leading cause of death from infectious diseases, following COVID-19. In 2022, an estimated 10 million people were affected by TB worldwide, including 5.6 million men, 3.3 million women, and 1.1 million children. In the same year, 1.5 million people died from TB, with Indonesia ranking third in the world for the highest TB cases after India and China (WHO, 2024). East Java ranked 8th in Indonesia in 2021 with 42,922 reported TB cases (Ningrum et al., 2022). TB patients commonly experience weight loss, fever, cough for

more than two weeks with sputum and blood, chest pain, dyspnea, reduced appetite, fatigue, night sweats (Agyeman & Asenso, 2017; Luies & Preez, 2020). Individuals who have been diagnosed with TB often experience concerns about their symptoms and the daily medications they are required to take. This condition makes TB patients vulnerable to changes in psychological responses, such as depression (Chen et al., 2024; Meylisa, 2021).

Depression is a condition that occurs due to feelings of sadness and loss of interest in a long time continuously for at least the last two weeks, individuals with depression typically present with the core triad of depressive symptoms such as depressed mood, loss of interest, fatigue (Rondón Bernard, 2018). In 2023, approximately 280 million people worldwide experienced depression and 700,000 died by suicide (WHO, 2023). There were 9 million people in Indonesia who experienced depression in 2017 (Fahmi et al.,

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2019). Studies examining the correlation between TB treatment and depression were conducted by Meylisa (2021) at Meruaxa Hospital, Banda Aceh, which reported significant results ($p = 0.000$) and by Salodia et al. (2019) at RHTC Najafgarh, New Delhi, which reported no significant results ($p = 0.241$). Due to differing results from previous studies and the absence of studies on this topic in Surabaya, this study aims to examine the correlation between the phases of TB treatment and depression levels in pulmonary TB patients.

Method

This study employed an analytical observational design with a cross-sectional approach and used consecutive sampling. Data were collected from February 17, 2024 to June 8, 2024 in accordance to the ethical clearance granted by the University of Surabaya's institutional ethical committee. Samples were obtained through sosiodemographic questionnaires and the Beck Depression Inventory (BDI-II) on pulmonary TB patients at Puskesmas Putat Jaya, Surabaya. BDI-II is a screening tool used to measure the severity of depression, with a completion time of approximately 5-10 minutes. This questionnaire has 21 items with 4 statements on each item that describes the condition over the past 2 weeks, such as mood depressed, loss of interest, feeling dissatisfied, fatigue, feeling worthless, difficulty concentrating, loss of appetite, and loss of sexual desire (Ginting et al., 2013).

The questionnaire's total score is categorized into 4 levels of depression: minimal depression (0-13), mild depression (14-19), moderate depression (20-28), and severe depression (29-63) (Jackson-Koku, 2016; Wang et al., 2020). Based on figure 1, 38 out of 45 respondents met the inclusion criteria, while the remaining 7 were excluded based on the exclusion criteria.

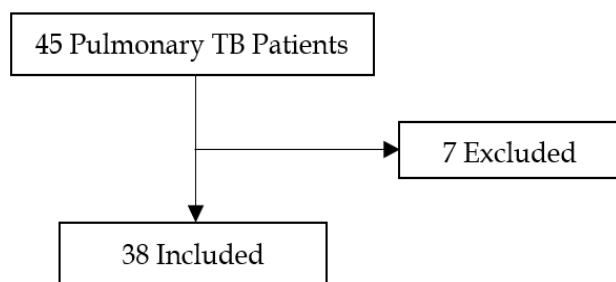


Figure 1. Participant flow diagram

Data were entered into Microsoft Excel for coding and then transferred to Jamovi version 2.6.23 for analysis. Spearman correlation was used to analyze the correlation between the phases of TB treatment and

depression levels, while Fisher's exact test was used to explore the correlation between depression levels and sosiodemographic factors, including gender, age, smoking status, comorbid medical history, and occupation. A p-value of less than 0.05 was considered statistically significant.

Result and Discussion

Depression Levels in Pulmonary TB Patients

Table 1 shows that most respondents did not experienced depression (84.2%). However, 6 respondents (15.8%) experienced depression, consisting of 2 respondents (5.3%) with mild depression, 1 respondents (2.6%) with moderate depression, and 3 respondents (7.9%) with severe depression.

Table 1. Depression Levels in Pulmonary TB Patients

Depression Levels	N	Percentage (%)
None/minimal	32	84.21
Mild	2	5.26
Moderate	1	2.63
Severe	3	7.89

Depression Levels in Pulmonary TB Patients Based on Gender

Table 2 presents the proportion of depression levels based on gender. The largest proportion of respondents were male, totaling 22 individuals (57.89%) and four of them experienced depression, with one (2.63%) having mild depression, one (2.63%) moderate depression, and two (5.26%) severe depression. The results of Fisher's exact test revealed no significant correlation between gender and depression levels ($p = 1.000$). The results of this study are in accordance with those reported by Salodia et al. (2019), which found that gender was not significantly correlated with depression levels. Kielan et al. (2021) stated that the factors contributing to depression in men include a family history of depression, unemployment, and economic issues.

Table 2. Depression Levels in Pulmonary TB Patients Based on Gender

Gender	Depression levels (%)			
	None/minimal	Mild	Moderate	Severe
Male	18 (47.37)	1 (2.63)	1 (2.63)	2 (5.26)
Female	14 (36.84)	1 (2.63)	0 (0)	1 (2.63)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Fisher's exact test: $p = 1.000$

Depression Levels in Pulmonary TB Patients Based on Age

Table 3 shows that the majority of respondents were adults, totaling 17 individuals (44.74%). There

were 4 respondents who experienced depression, consisting of two (5.26%) with mild depression and two (5.26%) with severe depression. Fisher's exact test revealed no significant correlation between age and depression levels ($p = 0.577$). This can occur due to other factors such as marital status, family history of depression, insomnia, lack of social support, and economic issues, which can also contribute to depression in individuals aged 20-40 years (Balawi et al., 2019; Cui & Fiske, 2022).

Table 3. Depression Levels in Pulmonary TB Patients Based on Age

Age	Depression Levels (%)			
	None/minimal	Mild	Moderate	Severe
Adults	13 (34.21)	2 (5.26)	0 (0)	2 (5.26)
Pre-elderly	10 (26.32)	0 (0)	0 (0)	1 (2.63)
Elderly	9 (23.68)	0 (0)	1 (2.63)	0 (0)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Fisher's exact test: $p = 0.577$

Depression Levels in Pulmonary TB Patients Based on Smoking Status

Table 4 shows that most of the respondents in this study were non-smokers with a total of 32 individuals (84.21%) and the results of Fisher's exact test analysis revealed no significant correlation between smoking status and depression levels ($p = 0.672$). The results of this study differ from those of Wu et al. (2023), who reported a correlation between smoking and depression, with the risk of depression increasing in line smoking frequency.

Table 4. Depression Levels in Pulmonary TB Patients Based on Smoking Status

Smoking Status	Depression Levels (%)			
	None/minimal	Mild	Moderate	Severe
Yes	5 (13.16)	0 (0)	0 (0)	1 (2.63)
No	27 (71.05)	2 (5.26)	1 (2.63)	2 (5.26)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Fisher's exact test: $p = 0.672$

Depression Levels in Pulmonary TB Patients Based on Comorbid Medical History

Based on Table 5, a total of 16 respondents (42.11%) had comorbidities, including diabetes mellitus in 11 respondents, hypertension in 3 respondents, prostate disease in 2 respondents aged over 70 years, kidney disease in 1 respondent, COPD in 1 respondent, and asthma in 1 respondent. Individuals with a history of comorbid diseases such as diabetes mellitus and hypertension often experience sadness, hopelessness, and stress related to their illness, which may increase their susceptibility to depression (Herrera et al., 2021). However, the results of Fisher exact test analysis in this study revealed that comorbid medical history were not

significantly correlated with depression levels ($p = 0.873$).

Table 5. Depression Levels by Comorbid Medical History

Comorbid Medical History	Depression Levels (%)			
	None/minimal	Mild	Moderate	Severe
Yes	13 (34.21)	1 (2.63)	1 (2.63)	1 (2.63)
No	19 (50)	1 (2.63)	0 (0)	2 (5.26)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Fisher's exact test: $p = 0.873$

Depression Levels in Pulmonary TB Patients Based on Occupation Type

The number of unemployed respondents in this study was the highest compared to other occupational categories, with 3 respondents experiencing depression. However, the results of Fisher's exact test analysis revealed no significant correlation between occupation and depression ($p = 0.969$). The results are inconsistent with the results reported by Evanytha et al. (2022) and Yang et al. (2024), who stated that individuals with unemployed status are more likely to experience depression due to economic pressure and social stigma. These individuals frequently experience low self-esteem, feelings of inferiority compared to employed individuals, and concern about their future.

Table 6. Depression Levels in Pulmonary TB Patients Based on Occupation Type

Type of Occupation	Depression Levels (%)			
	None/minimal	Mild	Moderate	Severe
Unemployed	14 (36.84)	1 (2.63)	1 (2.63)	1 (2.63)
Civil Servant	1 (2.63)	0 (0)	0 (0)	0 (0)
Private Employee	3 (7.89)	0 (0)	0 (0)	0 (0)
Self-employed	11 (28.94)	1 (2.63)	0 (0)	2 (5.26)
Student	3 (7.89)	0 (0)	0 (0)	0 (0)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Fisher's exact test: $p = 0.969$

Correlation Between the Phases of TB Treatment and Depression Levels

Based on the results in table 7, the majority of respondents who experienced depression were undergoing tuberculosis treatment in the intensive phase, with a total of 5 respondents, and only 1 respondent experienced depression during the continuation phase of tuberculosis treatment. This can occur because individuals who have recently been diagnosed with TB generally experience insomnia, loss of appetite, loss of interest, and concerns about complications or the prognosis of their illness (Agarwal & Sarthi, 2020; Kumar et al., 2016).

The spearman correlation analysis shown in table 7 revealed no significant correlation between the phases

of TB treatment and depression levels, with a p-value 0.093. The results of this study differ from those of Meylisa (2021), who conducted a study at Meruaxa Hospital, Banda Aceh, and reported a significant correlation between TB treatment duration and depression levels. However, the results of this study are consistent with those of Salodia et al. (2019), who conducted a study at RHTC Najafgarh, New Delhi, and found no significant correlation between the phases of TB treatment and depression levels ($p = 0.241$). Salodia et al. (2019) stated that depression may be caused by factors such as unemployment and low socioeconomic status. Kamble et al. (2022) also reported that depression can be caused by other contributing factors aside from the phases of TB treatment, including comorbid diseases, negative stigma, gender, unemployment, and low economic status.

Table 7. Correlation Between the Phases of TB Treatment and Depression Levels

TB Treatment Phases	Depression Levels (%)			
	None/minimal	Mild	Moderate	Severe
Intensive	14 (32.84)	2 (5.26)	1 (2.63)	2 (5.26)
Continuation	18 (47.37)	0 (0)	0 (0)	1 (2.63)
Total	32 (84.21)	2 (5.26)	1 (2.63)	3 (7.89)

Spearman: $r = -0.276$, $p = 0.093$

Conclusion

Based on the data analysis results in this study, most TB patients did not experience depression and there was no significant correlation between the phases of TB treatment and depression levels in pulmonary TB patients at Puskesmas Putat Jaya, Surabaya.

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Conceptualization, R. N. L., A. D., K. M. A. A.; data collection, R. N. L.; analysis, R. N. L.; writing and editing, R. N. L.; supervision, A. D., and K. M. A. A.

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Conflicts of Interest

The author declare this study has no conflict of interest.

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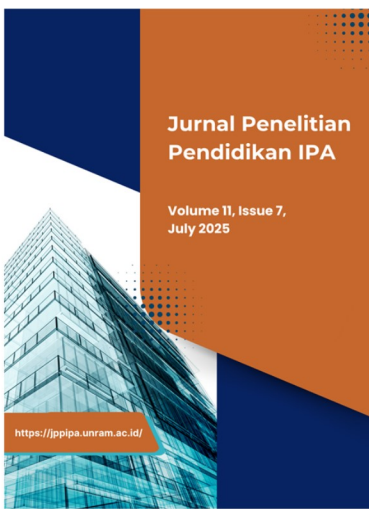
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Jurnal Penelitian Pendidikan IPA

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Vol. 11 No. 7 (2025): July



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Aan Dwi Sentana , Sitti Rusdianah Jafar , Moh. Hasbi , Desty Emilyani , Lale Wisnu Andrayani , Dewi Purnamawati , Mardiatun , Gusti Ngurah Anom
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The Influence of the TGT (Team Game Tournament) Type Cooperative Learning Model Assisted by Interactive Wordwall Media on the Interest and Science Learning Outcomes of Junior High School Students

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Dynamics of Soil Organic Carbon at Different Elevations in Cocoa Land-Use Systems

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Development of Interactive Multimedia for Sciences Based on Problem-Based Learning in Grade V of Elementary School

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An Innovative Guided Inquiry Worksheet Integrated with the Nested Approach to Enhance Students' Critical Thinking Skills in Chemical Equilibrium

Favian Agung Difa' Saskara , [Bertha Yonata](#) 

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Application of Bandura's Theory to Breastfeeding Self-Efficacy of Mothers in the Working Area of Dahlia Health Center, Makassar City

Ayatullah Harun , Ruqaiyah , Noviyani Hartuti , Fatmawati Amir , Basmalah Harun

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Physics Module Based on SETS (Science, Environment, Technology, and Society) and Its Impact on Students' Scientific Literacy

Fiskia Ruzaina , Helmi , Muhammad Arsyad

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The Development of an Ethnobotanical Pocketbook on Traditional Games in Kapuas Hulu Regency

Winda Rahman , Hanum Mukti Rahayu , Ahmad Faisal Amri

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Chemical and Functional Characteristics of Soy Milk Kefir at Various Doses of

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Ifall , Sultan Bisinda , Sri Sudewi , Sitti Sabariyah , Ratnawati

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Factors That Influence Orange Farmers Using Mixed Cropping Pattern in Nagori Bandar Purba, Purba District, Simalungun Regency

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Development of E-LKPD Based on Group Investigation Integrated with Citizen Science Project to Improve Analytical Thinking and Collaboration Abilities of Junior High School Students

Imam Sajidi , Parmin

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Analyzing the Acceptance of IoT-Based Toddler Scales Among Health Workers Using the Technology Acceptance Model (TAM)

Fidyah Ajeng Wulandari , Wirarama Wedashwara , Heri Wijayanto 

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Effectiveness of Dick & Carey Instructional Design Model and Learning Attitudes Towards Science Learning Outcomes at UPT SMPN 2 Bayang

Kiki Permatasari , Darmansyah , Zulhendri Zen , Ridwan
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Nakita Chairunnisa , Wira Dharma , Alia Rizki
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Development of Stand Alone Interactive E-Modules on the Subject of Fundamentals of Network Engineering and Telecommunications in SMK Imelda Medan

Marlina Nasution , Nizwardi Jalinus , Dedy Irfan , M Giatman , Lasyatta Syaifullah
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Comparative Morpho-anatomy of Two Myriophyllum Species (Haloragaceae) in West Lombok

Nisa' Wulandari , Andrey Efremov , Aida Muspiah , Tri Mulyaningsih 

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Animals in Tradition and Culture: An Ethnozoological Study of the Indigenous People of Seram Island

Marthina Tjoa , Rony Marsyal Kunda , Henderina Lelloitery , Maya MS Puttileihalat

685-692

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The Effect of Doses of Various Types of Manure and NPK Mutiara on the Growth and Production of Pagoda Mustard (*Brassica narinosa* L.)

Marulam MT Simarmata 

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Assessing Students' Science Process Skills: Designing a Performance-Based

Assessment Instrument for Saponification Lab Activities

Aztiannisa Zahra , Nahadi , Wiwi Siswaningsih

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Development of Contextual Based Science Module

Ovilia Putri Utami Gumay , Ivoni Susanti , Wahyu Arini

713-721


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Design and Technical Evaluation of Evaporative Cooling for Prolonging Fresh Potato Shelf Life in Tropical Climates

Ireine Adriana Longdong , Dedie Tooy , Juventus Yoel Mochtar , Lady C. Ch. E. Lengkey ,
Herry F. Pinatik , Denny Saroinsong

722-728

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Exploring The Impact of Deep Learning Approaches on Geography Education: Student Perceptions and Educational Implications

Syafril , Junaidin

729-737

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Application of Remote Sensing for Mapping Vegetation Density Using Normalized Difference Vegetation Index (NDVI) in Langsa City Mangrove Forest

Fuji Attariq Unsha , Saida Rasnovi , Dahlan
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Application of MAT Using Methyl Eugenol and Cue-Lure to Control Bactrocera spp. in Vegetable Centers of North Sulawesi

Maxi Lengkong , Caroulus S. Ranten , Daisy S. Kandowangko
746-751

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Development of a Initialization and Supply Chain Resilience Model to Enhance Operational Performance in The Software Development Industry

Muhammad Mahdi , Jonny 

752-761

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Mathematic Games as an Educational Technology Strategy to Improve Motivation and Learning Outcomes of Elementary School Students

Serni Mulia Hartati , Ulfia Rahmi , Jasrial , Ridwan

762-769

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Development of YouTube-Based Electrolysis Learning Media to Increase Student Learning Motivation

Ghaitsa Zahira Shofa Pradana Putri , Hayuni Retno Widarti

770-778

DOI: 10.29303/jppipa.v11i7.11759

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Photovoltaic Cell Parameter Estimation Using Moth-Flame Optimization Algorithm

Fitriah Husin  , Ayong Hiendro

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Development of Acid Base E-Module Based on Guided Discovery Learning to Improve Digital Literacy Skills of Senior High School Phase F Students

Haifa Hafifah , Yerimadesi , Alizar , Desy Kurniawati

789-796

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Value Chain of Potato Commodity (*Solanum tuberosum*) Upland Farmers in Madoinding District, South Minahasa Regency

Caroline B.D. Pakasi , Geraldine C.D. Podung , Mukhlis 

797-803

DOI: 10.29303/jppipa.v11i7.12190**Statistics:**  0 |  0 Citations 0 PDF

Development Learning Management System Utilizing Google Workspace Integrated with Wordwall Based on Gamification in Non-Formal Education


Elvirawaty , Alwen Bentrì , Abna Hidayati , Ulfia Rahmi

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Empowering Future Innovators: Harnessing Project-Based Learning and AI to Enhance Analytical Thinking, Creativity, and Collaboration Skill in Exploring the Circulatory System SMAN 1 Magelang City

Muhammad Khoirul Antony , Sendy Putra Pradana , Ahmad Naharuddin Ramadhan ,
Susi Dewiyeti , Ermia Hidayati 

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Population Structure and Production Performance of Native Chicken as a Source of Local Animal Protein

Estepanus L. S. Tumbal , Tri Jaya Ganeputra , Mery C. Simanjuntak

822-828

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Development of Differentiated E-LKPD Integrated with HOTS and Multiple Intelligences to Enhance Students' Systems Thinking Skills

Hanna Benedicta Simanjuntak , Dewi Lengkana , Tri Jalmo , Abdurrahman

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Development of LKPD IPAS Using QR-Code with Discovery Learning Model to Improve Students' Critical Thinking Class V Elementary School

Retna Yupika , Fetri Yeni J , Abna Hidayati , Ulfia Rahmi

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Integration Internet of Things (IoT) and ChatGpt in The Teaching of Photosynthesis and Water Quality at SDN 2 Lebo

Aspin , Ikhlusal Ardi Nugroho , Abubakar , Muh Asharif Suleman

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Development of Augmented Reality Media on the Material of Pteridophyta Plant Classification on the Slopes of Mount Gunitir as a Biology Teaching Material for Class X

Rini Fauziah , Evi Hanizar , Hepta Bungsu Agung Jayawardana

854-864

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Development of Local Wisdom-Based Physics Supplement Books to Improve Science Literacy of Students at SMAN 5 Wajo

Fauziah , Jasruddin Daud Malago , M. A. Martawijaya



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Analysis of Literacy Ability of 10th Grade High School Students Using the Minimum Competency Assessment (AKM) Based on Chemical Science at SMAN Karangpandan

Hafid Al Afif , Maria Ulfa , Sri Yaminah , Mohammad Masykuri , Bakti Mulyani , Ari Syahidul Shidiq

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Determination of Diagnostic Reference Level (DRL) in Non-Contrast and Contrast Thorax CT Scan Examinations at Bali Mandara Regional Hospital

Ni Luh Emy Pramitha , Gusti Ngurah Sutapa , Ni Luh Putu Trisnawati , Ni Nyoman Ratini , Hery Suyanto , Winardi Tjahyo Baskoro

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DOI: 10.29303/jppipa.v11i7.10344

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Utilization of Medicinal Plants by the Community in East Rote District, Rote Ndao Regency

Aprilia Ballo  , Sonya T. Nge

894-899

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Access to Digital as a Moderating Influence of Parental Role and Balanced Screen Time on Elementary School Children's Digital Literacy Educationally

Suryadi , Victor Maruli Tua L. Tobing , Sri Utami

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Microplastic Pollution in the Aquatic Ecosystem of Gili Trawangan, Lombok: Abundance, Characteristics, and Implications in Tourism Area

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Development of a STEM-Based Physics Instructional Tool to Encourage Students' Collaboration Skills in Inclusive High School

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Development of Acid-Base E-Modules Based on Guided Discovery Learning Using React Native to Improve Problem Solving Skills of Phase F High School Students

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Scientific Literacy and Critical Thinking: An Analysis of Students' Evaluation of Local Bioprospecting Resources

Linna Fitriani , Ria Dwi Jayati , Tomi Hidayat



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Development of Discovery Learning Model Module on Chemical Kinetics Material to Improve Critical Thinking Skills of Phase F Grade XI Senior High School Students

Ike Yusrianti , Alizar , Rahadian Zainul , Riga

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Development of Integrated Science E-Learning Materials Integrated with Ethno-PjBL to Encourage Students' 21st Century Skills

Ilma Hayatil Husna , Asrizal

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Environmental Suitability and Supportability for Seaweed Cultivation Development in Terujung Coastal Area, Labuhan Aji, Sumbawa

Hasdinar Firda , Bambang Widigdo , Zairion , Gatot Yulianto

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Contextual Learning on Type 2 Diabetes Mellitus Based on Case Studies: Educational Media Innovation in Science Learning in Senior High Schools

Muhammad Syahrir , Dewi Rahayu , T. Khairol Razi , Muzakir Muhammad Amin , Sulaiman , Flora Eka Sari

1004-1015

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Design and Build IoT Smart Home System with Blocks Based App Inventor Programming

Agus Suharto

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Analysis of the Correlation Between Extracurricular Management and Students' Academic Learning Motivation at SMA Muhammadiyah 1 Tangerang, Indonesia

Ruknan

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Eka Sarofah Ningsih , Khusnul Nikmah , Ida Susila

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Development of Interactive E-Modules Based on Google Sites to Improve Critical Thinking Skills and Agility at SMKN 2 Jember

Fierman Pradityo Utama Putra , Eges Triwahyuni , Hariyanto



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The Relationship between House Environmental Condition and Mosquito Larvae Density (Diptera: Culicidae) in Medan Denai Sub-District, Medan City

Merina Panggabean , Yoan Carolina Panggabean , Lambok Siahaan , Adelina Haryani Sinambela , Irma Sepala Sari Siregar

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Detection of Formalin in Salted Squid Using Dragon Fruit Peel Extract (*Hylocereus polyrhizus*)

Supriyatin , Hery Prambudi

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The Potential of Fish in Lake Padong Pangeran Pati as a Biology Learning Resource

Putri Dwi Setya Ningsih , Eko Dewantoro , Mahwar Qurbaniah

1082-1091

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Development of Animalia Bio Board Game Media to Improve Students' Analytical Thinking and Collaboration Skills

Dea Merly Kirnasari , Evy Yulianti

1092-1102

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Development of Problem-Based Learning E-Worksheet to Improve Student Learning Outcomes in Acid-Base Material for Grade XI Senior High School Students Phase F

Herianto , Okta Suryani

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Supratikno , Enggar Utar  , Najmi Firdaus , Lucy Adi Tama
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Analysis of Independent Curriculum Management at SMK Palu City in Central Sulawesi Province

Rudin M , Maria Lea Frensy Bakarbesy
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Development of Guided Inquiry-Based Learning Modules to Improve Students' Science Process Skills

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The Influence of 4G Providers in the Honor of Kings Game on Player Performance in Modes (Custom, Skin Visualization, and Ranked)

Enrico Ananta Pratama , Djul Fikry Budiman , Made Sutha Yadnya
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Lilis Tasmayanti , L.R. Retno Susanti , Erna Retna Safitri

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Development of E-Physics Teaching Material Integrated with Augmented Reality and Ethno-Meaningful Learning to Promote Students' 21st Century Skills

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Development of Virtual Reality Laboratory Integrated with Artificial Intelligence for Acid-Base Titration Practicum

Nova Irawati Simatupang  , Elferida Sormin , Leony Sanga Lamsari Purba , Nelius Harfa ,
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The Influence of the Problem-Based Learning Model Assisted by Electronic Student Worksheets on the Science Learning Outcomes

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Sukardiyono , Riki Perdana  , Riski Putriana , Pramudya Wahyu Pradana , Jumadi

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Syafruddin Rais , Toni Ari Wibowo

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Diagnosis of Difficulties in Learning Stoichiometry Based on College

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Raehanah , Syarifatul Mubarak

1227-1234

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Lili Farlikhatun , Anisaul Husna , Berliana Puji Restuti , lin Munarti , Kurniasih Anisa Putri , Rif'ah Mutiah , Sundari

1235-1242

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Muhammad Fachri Muslim , Arnellis , Ahmad Fauzan , Yerizon

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