

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; Luijs & 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 sociodemographic 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 45 respondents met the inclusion criteria, while the remaining 7 were excluded based on the exclusion criteria.

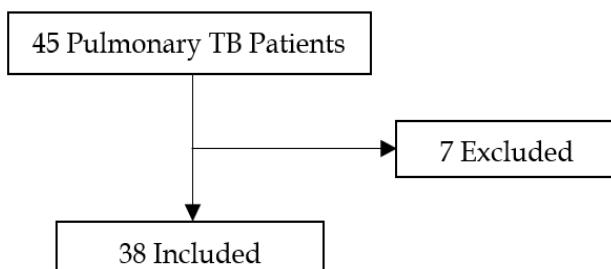


Figure 1. Participant flow diagram

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 sociodemographic 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 experience depression (84.2%). However, 6 respondents (15.8%) experienced depression, consisting of 2 respondents (5.3%) with mild depression, 1 respondent (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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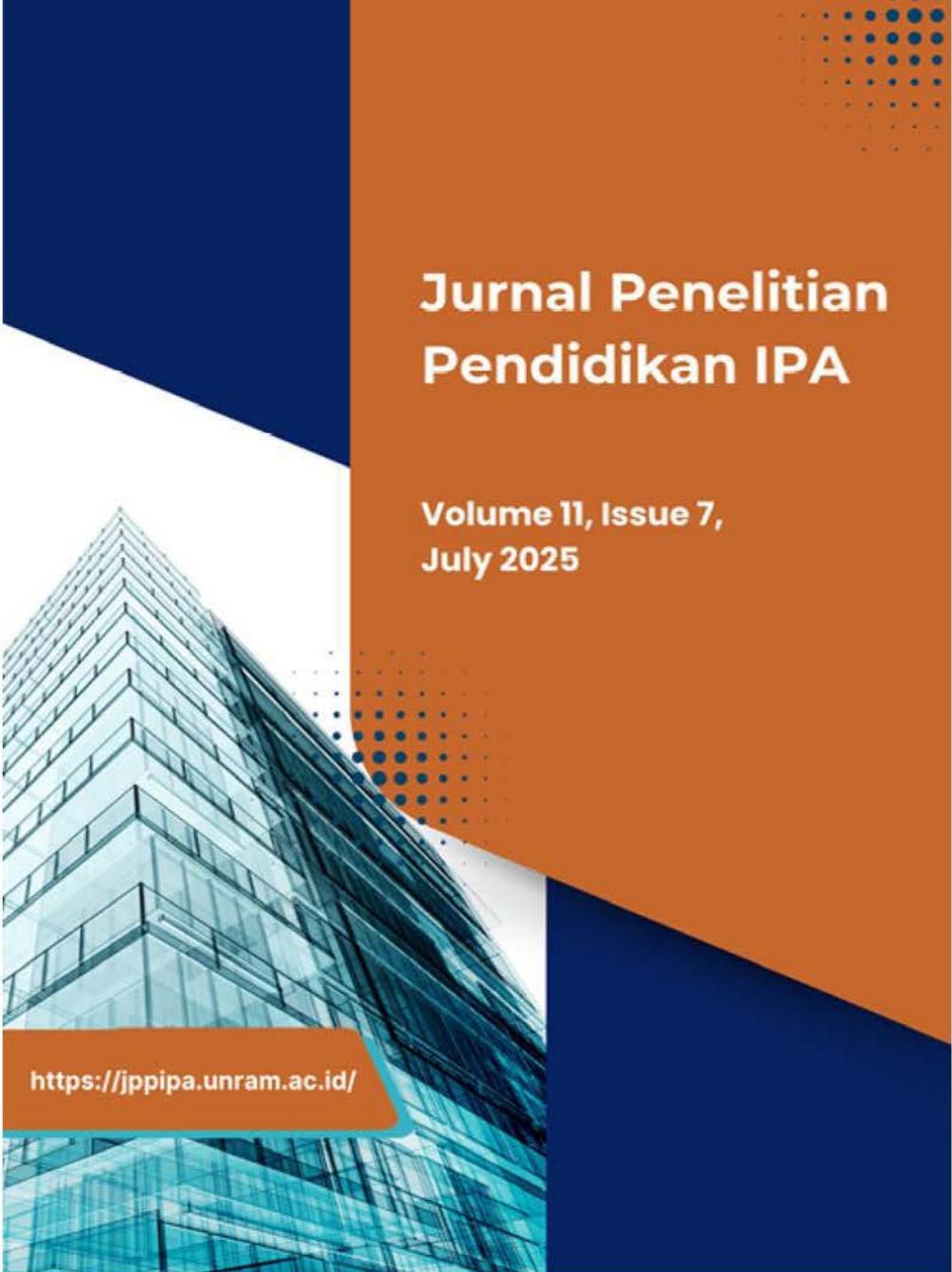
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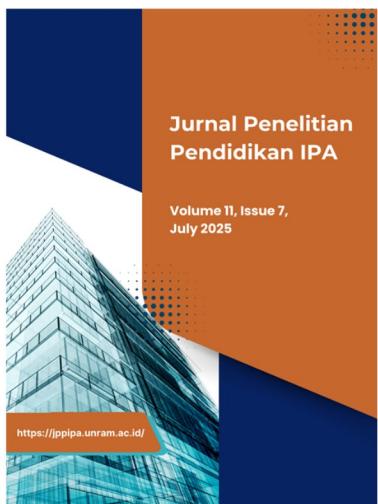
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Website-based School Application Redesign with Design Thinking Method

(Case Study: Ezzi School)Abednego Dwi Septiadi  , Enjeli Clstia Sukmawati 

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 **PDF****Effect of Rice Bran Oil Addition on the Physicochemical, Microstructural, and Antioxidant Properties of Chicken Corned Meat**Ahmed Hafizd Athththoriq  , Agus Susilo , Herly Evanuarini , Dedes Amertaningtyas ,

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 **PDF****Application of Problem-Based Learning Model Assisted by Audio Visual to Improve Critical Thinking Skills of Elementary School Children**

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 **PDF****Development of Business and Energy Module Based on Problem Based Learning**

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Potential of Hanjeli (*Coix lacryma-jobi*) as an antifungal Microsporum Gypseum Causes Skin Infections: Extract, Boiled Water, Kombucha, and Bath Soap

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Science Literacy through STEM-Based Project Based Learning Model

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Development of Biodiversity Encyclopedia Based on Flipbook to Improve Student Learning Outcomes in Senior High School 6 Samarinda

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Edible Coating Application Based on Snail Shell Chitosan in the Effort to maintain the Quality and Storage of Tofu

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Implementation of Problem Based Learning-Science Technology Engineering Art and Mathematics Module to Improve Students' Science Process Skills

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378-386



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Innovating Bacterial Cultivation Practicums to Promote Deep Learning: A Trial and Reconstruction of Student Worksheets (LKPD)

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387-395

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The Effect of Seaweed Soy Tempe Extract on the Reduction of Blood Sugar Levels in Alloxan Induced Rats (*Mus musculus*)

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Isolation of Secondary Metabolite Compounds from the Soft Coral *Isis* sp., Antimicrobial Testing and Molecular Docking Studies

Imran , Fajri Fitra Amalia , Sahidin , Agung Wibawa Mahatva Yodha  , Nohong , I Wayan Sutapa  , Thamrin Azis
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Prevalence of Gastrointestinal Parasites in Endangered Captive Javan Gibbons (*Hylobates moloch*, Audebert, 1797) of Taman Margasatwa Ragunan, Jakarta Selatan

Anisa Putri Sukmaningrum  , Luthfiralda Sjahfirdi , Siti Nursheena Mohd Zain
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DOI: 10.29303/jppipa.v11i7.11392

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The Use of Traditional Timorese Media in Project-Based Learning on the Subject of Electronic Configuration in Chemistry

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Implementation of the Hybrid Flexible-Station Rotation Learning Model on Critical Thinking and Creativity Skills in Elementary Schools in Blitar

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Daily Behavior of Reintroduction Candidate Orangutans (*Pongo pygmaeus*) at Jerora Forest School, Sintang Orangutan Center, West Kalimantan

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The Impact of Problem Based Learning with Mind Mapping on Learning Outcomes in Ecosystem Lesson

Mohammad Jamhari , Yulia Windarsih , Manap Trianto

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Pre-Wedding Education for Teenagers: Science Literacy, Character and Morals

Megawati Naibaho  , Blasius Superma Yese , Sergius Lay , Bartolomeus Sihite ,
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DOI: [10.29303/jppipa.v11i7.11642](https://doi.org/10.29303/jppipa.v11i7.11642)**Statistics:**  3 |  3 **Citations**

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Sugar and Fiber Content in Sorghum Seeds (*Sorghum bicolor (L.) Moench*) From the Application of Rice Husk Biochar and Liquid Cow Urine Organic Fertilizer

Syamsiar , Indrianto Kadekoh , Marhani , Maemunah , Rahmi Rozali , Rachmat Zainuddin , Nur Salam , Nina Humaerah

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Effectiveness of Project-Based Learning in Textile Dyeing Course to Improve Work Readiness as Entrepreneurs in the Digital Era

Sri Zulfia Novrita  , Nizwardi Jalinus , Ridwan , Rijal Abdullah , Weni Nelmira , Adriani

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Application of Risk Management Science in Construction Project Learning: Cost Contingency Study in Malang Raya Housing

Fairuz Firyal Qonitah  , Achfas Zacoeb , Retno Anggraini

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Mathematical Problem-Solving Skills in Solving PISA Model Questions on Space Content for Prospective Teacher Students

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DOI: 10.29303/jppipa.v11i7.11566

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Development of Jobsheet Based on Collaborative Project Based Learning in Lathe Machining Engineering Subjects

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510-518

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Statistics:  3 |  5

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Snakes and Ladders Game Method and Flashcards on Knowledge, Attitudes

and Skills of Karang Taruna Youth Regarding Basic Life Support

Aan Dwi Sentana  , Sitti Rusdianah Jafar , Moh. Hasbi , Desty Emilyani , Lale Wisnu Andrayani , Dewi Purnamawati , Mardiatun , Gusti Ngurah Anom
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DOI: 10.29303/jppipa.v11i7.11614

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Indirect Tensile Fatigue Test (ITFT) Analysis of Asbuton Mixture with Used Oil Additives and HDPE

M Ari Husni , I Dewa Made Alit Karyawan  , IAO Suwati Sideman
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Development of Experimental Digital Comics to Stimulate Kindergarteners' Science Process Skills

Fatwini , I Gede Astawan , Gede Wira Bayu
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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

Luh Putu Yeni Andriyani  , I Nyoman Tika , Putu Artawan
553-560



DOI: [10.29303/jppipa.v11i7.11519](https://doi.org/10.29303/jppipa.v11i7.11519)**Statistics:**  0 |  1

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

Danang Widjajanto , Rachmat Zainuddin , Rois , Abdul Rahman , Moh. Adnan Khaliq ,

Us wah Hasanah , Rosmaniar Gailea  , Fera

561-569

DOI: [10.29303/jppipa.v11i7.11999](https://doi.org/10.29303/jppipa.v11i7.11999)**Statistics:**  4 |  2

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

Dhea Armadhani , Fetri Yeni J , Zelhendri Zen , Rayendra

570-578

DOI: [10.29303/jppipa.v11i7.11420](https://doi.org/10.29303/jppipa.v11i7.11420)**Statistics:**  3 |  3

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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 

579-588

DOI: [10.29303/jppipa.v11i7.11515](https://doi.org/10.29303/jppipa.v11i7.11515)**Statistics:**  1 |  2

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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

589-597

DOI: [10.29303/jppipa.v11i7.11596](https://doi.org/10.29303/jppipa.v11i7.11596)

Statistics:  16 |  0

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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

598-608

DOI: [10.29303/jppipa.v11i7.12216](https://doi.org/10.29303/jppipa.v11i7.12216)

Statistics:  3 |  0

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 PDF

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

Winda Rahman , Hanum Mukti Rahayu , Ahmad Faisal Amri

609-618

DOI: [10.29303/jppipa.v11i7.11698](https://doi.org/10.29303/jppipa.v11i7.11698)

Statistics:  2 |  5

 Citations

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 PDF

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

Starter and Addition of Telang Flower Juice (*Clitoria ternatea* L.)

Ifall  , Sultan Bisinda , Sri Sudewi , Sitti Sabariyah , Ratnawati
619-627

DOI: 10.29303/jppipa.v11i7.11035

Statistics:  3 |  5



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 PDF

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

Wahyunita Sitinjak
628-632

DOI: 10.29303/jppipa.v11i7.5381

Statistics:  0 |  1



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 PDF

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
633-644

DOI: 10.29303/jppipa.v11i7.11707

Statistics:  3 |  2



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 PDF

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

Fidyah Ajeng Wulandari , Wirarama Wedashwara , Heri Wijayanto 
645-652

DOI: 10.29303/jppipa.v11i7.11442



Statistics:  1 |  2

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 PDF

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

653-658

DOI: [10.29303/jppipa.v11i7.12241](https://doi.org/10.29303/jppipa.v11i7.12241)

Statistics:  1 |  3

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 PDF

Spatial Analysis of Carbon Monoxide Concentrations in Banda Aceh Using Google Earth Engine

Nakita Chairunnisa  , Wira Dharma , Alia Rizki

659-663

DOI: [10.29303/jppipa.v11i7.11089](https://doi.org/10.29303/jppipa.v11i7.11089)

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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

664-671

DOI: [10.29303/jppipa.v11i7.11428](https://doi.org/10.29303/jppipa.v11i7.11428)

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 PDF

Comparative Morpho-anatomy of Two *Myriophyllum* Species (Haloragaceae) in West Lombok

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

672-684

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Statistics:  10 |  12 Citations

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 PDF

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

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

685-692

DOI: 10.29303/jppipa.v11i7.11286

Statistics:  2 |  2 Citations

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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 

693-701

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 PDF

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

Assessment Instrument for Saponification Lab Activities

Aztiannisa Zahra , Nahadi , Wiwi Siswaningsih

702-712

DOI: 10.29303/jppipa.v11i7.11757

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Development of Contextual Based Science Module

Ovilia Putri Utami Gumay  , Ivroni Susanti , Wahyu Arini

713-721

DOI: 10.29303/jppipa.v11i7.11282

Statistics:  6 |  4



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

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

722-728

DOI: 10.29303/jppipa.v11i7.12163

Statistics:  2 |  0



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

Syafril , Junaidin

729-737

DOI: 10.29303/jppipa.v11i7.12276

Statistics:  4 |  0



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 PDF

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

738-745

DOI: [10.29303/jppipa.v11i7.11530](https://doi.org/10.29303/jppipa.v11i7.11530)

Statistics:  2 |  0

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 PDF

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

DOI: [10.29303/jppipa.v11i7.10882](https://doi.org/10.29303/jppipa.v11i7.10882)

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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

DOI: 10.29303/jppipa.v11i7.10749

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 PDF

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

DOI: 10.29303/jppipa.v11i7.12253

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 PDF

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

779-788



DOI: [10.29303/jppipa.v11i7.10892](https://doi.org/10.29303/jppipa.v11i7.10892)**Statistics:**  0 |  0

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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

DOI: [10.29303/jppipa.v11i7.11382](https://doi.org/10.29303/jppipa.v11i7.11382)**Statistics:**  0 |  0

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

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

797-803

DOI: [10.29303/jppipa.v11i7.12190](https://doi.org/10.29303/jppipa.v11i7.12190)**Statistics:**  0 |  0

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

Elvirawaty , Alwen Bentri , Abna Hidayati , Ulfia Rahmi

804-812

DOI: [10.29303/jppipa.v11i7.11729](https://doi.org/10.29303/jppipa.v11i7.11729)**Statistics:**  0 |  0

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 PDF

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  , Senty Putra Pradana , Ahmad Naharuddin Ramadhan  ,

Susi Dewiyeti  , Ermia Hidayati 

813-821

DOI: [10.29303/jppipa.v11i7.11004](https://doi.org/10.29303/jppipa.v11i7.11004)

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 PDF

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

DOI: [10.29303/jppipa.v11i7.11582](https://doi.org/10.29303/jppipa.v11i7.11582)

Statistics:  0 |  0

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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

829-835

DOI: [10.29303/jppipa.v11i7.10376](https://doi.org/10.29303/jppipa.v11i7.10376)

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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
836-843

DOI: 10.29303/jppipa.v11i7.11419

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

Aspin  , Ikhlasul Ardi Nugroho , Abubakar , Muh Asharif Suleman
844-853

DOI: 10.29303/jppipa.v11i7.12156

Statistics:  0 |  0



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

Rini Fauziah , Evi Hanizar , Hepta Bungsu Agung Jayawardana
854-864

DOI: 10.29303/jppipa.v11i7.11621

Statistics:  0 |  0



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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



865-872

DOI: 10.29303/jppipa.v11i7.5602**Statistics:**  0 |  0 Citations

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 PDF

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 Yamtinah , Mohammad Masykuri , Bakti Mulyani , Ari Syahidul Shidiq
873-883

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 PDF

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
884-893

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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

900-906

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

Nadda Khalila Chairunnisa , Moh. Awaludin Adam  , Dining Aidil Candri 

907-916

DOI: [10.29303/jppipa.v11i7.7485](https://doi.org/10.29303/jppipa.v11i7.7485)

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 PDF

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

Iva Nandya Atika , Shima Hafidz Adiatri Buana , Ailsa Zada Yusrika , Ediyanto

917-925

DOI: [10.29303/jppipa.v11i7.9382](https://doi.org/10.29303/jppipa.v11i7.9382)

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Using the STEM Approach to Improve Students' Critical Thinking Abilities in an Integrated Flipped Classroom in Physics Learning

Miswatal Hasanah  , Meriza Faradilla , Tria Marvida
926-933

DOI: [10.29303/jppipa.v11i7.10660](https://doi.org/10.29303/jppipa.v11i7.10660)

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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

Rivo Juita Sudirman , Yerimadesi , Andromeda , Riga , Nofri Yuhelman
934-946

DOI: [10.29303/jppipa.v11i7.12212](https://doi.org/10.29303/jppipa.v11i7.12212)

Statistics:  0 |  0



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Analysis of Factors Affecting The Success of Nutrition Improvement Programs for Primary School Children

Ngurah Mahendra Dinatha , Andi Subhan Amir , Nurul Hidayah , R.A Wigati , Anis Satus Syarifah
947-956

DOI: [10.29303/jppipa.v11i7.10711](https://doi.org/10.29303/jppipa.v11i7.10711)

Statistics:  0 |  0



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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



957-964

DOI: 10.29303/jppipa.v11i7.12079**Statistics:**  0 |  0 **Citations**

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 **PDF****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

965-973

DOI: 10.29303/jppipa.v11i7.12229**Statistics:**  0 |  0 **Citations**

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

Ilma Hayatil Husna , Asrizal

974-989

DOI: 10.29303/jppipa.v11i7.11613**Statistics:**  0 |  0 **Citations**

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

Hasdinar Firda , Bambang Widigdo , Zairion , Gatot Yulianto

990-997

DOI: 10.29303/jppipa.v11i7.11449**Statistics:**  0 |  0 **Citations**

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Simultaneous Analysis of Preservatives in Beverages Samples Using High Pressure Liquid Chromatography

Tetty Uli Oktaviana Situmeang , Jansen Silalahi , Hotnida Sinaga , Candra Sigalingging
998-1003

DOI: 10.29303/jppipa.v11i7.9018

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 PDF

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

DOI: 10.29303/jppipa.v11i7.12035

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 PDF

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

Agus Suharto 
1016-1026

DOI: 10.29303/jppipa.v11i7.12028

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 PDF

Infusion of Strychnos lucida as an Alternative Therapy for Malaria Treatment: An In Vivo Study in Plasmodium berghei-Infected Mice (Mus musculus)

Meillisa Carlen Mainassy , Abdul M. Ukratalo
1027-1038

DOI: [10.29303/jppipa.v11i7.11270](https://doi.org/10.29303/jppipa.v11i7.11270)

Statistics:  0 |  0

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

Ruknan
1039-1045

DOI: [10.29303/jppipa.v11i7.12395](https://doi.org/10.29303/jppipa.v11i7.12395)

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The Influence of Maternal Nutrition and Micronutrient Intake on the Incidence of Low Birth Weight (LBW)

Eka Sarofah Ningsih , Khusnul Nikmah , Ida Susila
1046-1055

DOI: [10.29303/jppipa.v11i7.12018](https://doi.org/10.29303/jppipa.v11i7.12018)

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 PDF

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



1056-1065

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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

1066-1074

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

Supriyatn , Hery Prambudi

1075-1081

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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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 PDF

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

Dea Merly Kirnasari  , Evy Yulianti

1092-1102

DOI: 10.29303/jppipa.v11i7.11549

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 Citations

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 PDF

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

1103-1111

DOI: 10.29303/jppipa.v11i7.11929

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 Citations

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Scoping Review on Knowledge, Attitudes, and Practices of Safety Promotion in Academic Laboratories

Turmaningsih Surya Pratama  , Bagoes Widjanarko , Daru Lestantyo , Yuliani Setyaningsih

1112-1131

DOI: 10.29303/jppipa.v11i7.11314

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 Citations

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 PDF

Characteristics of Vaname Shrimp Farm Residual Water Across Different Shrimp Ages

Supratikno , Enggar Utar  , Najmi Firdaus , Lucy Adi Tama
1132-1135

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Analysis of Independent Curriculum Management at SMK Palu City in Central Sulawesi Province

Rudin M , Maria Lea Frensy Bakarbessy
1136-1142

DOI: 10.29303/jppipa.v11i7.10353

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Development of Guided Inquiry-Based Learning Modules to Improve Students' Science Process Skills

Nurfausiah , Sidin Ali , Helmi
1143-1152

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 PDF

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
1153-1164



DOI: [10.29303/jppipa.v11i7.11327](https://doi.org/10.29303/jppipa.v11i7.11327)**Statistics:**  0 |  0

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Transformation of Food Web Learning: A Study of Canva-Assisted Interactive Multimedia Implementation at Elementary School Level

Lilis Tasmayanti , L.R. Retno Susanti , Erna Retna Safitri

1165-1171

DOI: [10.29303/jppipa.v11i7.12039](https://doi.org/10.29303/jppipa.v11i7.12039)**Statistics:**  0 |  0

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

Rima Melani Putri , Asrizal , Mutiara Nurul Fitri 

1172-1185

DOI: [10.29303/jppipa.v11i7.12214](https://doi.org/10.29303/jppipa.v11i7.12214)**Statistics:**  0 |  0

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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 ,

Adi Nugroho

1186-1192

DOI: [10.29303/jppipa.v11i7.11587](https://doi.org/10.29303/jppipa.v11i7.11587)**Statistics:**  0 |  0

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The Influence of the Problem-Based Learning Model Assisted by Electronic Student Worksheets on the Science Learning Outcomes

Fahrur Rozi  , Nirwana Anas  , Eka Margareta Sinaga  , Yusron Abda'u Ansyah 
1193-1202

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 PDF

The Effectiveness of the Phet-Assisted Learning Cycle 5E Model to Improve Students' Critical Thinking Skills and Science Literacy on the Topic of Sound Waves

Sukardiyyono , Riki Perdana  , Riski Putriana , Pramudya Wahyu Pradana , Jumadi
1203-1214

DOI: 10.29303/jppipa.v11i7.10902

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Enhancing Learning Outcomes: A Study of Key Educational Method Drivers

Syafruddin Rais , Toni Ari Wibowo
1215-1226

DOI: 10.29303/jppipa.v11i7.11468

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 PDF

Diagnosis of Difficulties in Learning Stoichiometry Based on College

Students' Education Backgrounds

Raehanah , Syarifatul Mubarak

1227-1234

DOI: 10.29303/jppipa.v11i7.11153

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 PDF

Exploring the Role of Complementary Herbal Therapies (Red Ginger, Aloe Vera, Tangerang Turmeric, Cinnamon, Binahong Leaves, Green Betel Leaves) in Science Education: A Case Study on the Healing Process of Second-Degree Perineal Wounds in Postpartum Mothers

Lili Farlikhatun , Anisaul Husna , Berliana Puji Restuti , Iin Munarti , Kurniasih Anisa Putri ,

Rif'ah Mutiah , Sundari

1235-1242

DOI: 10.29303/jppipa.v11i7.10621

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A Ethnomathematics Study of Minangkabau Traditional Food: Case Study in Lamang, Basung Cake, Onde-Onde, and Mangkuak Cake

Muhammad Fachri Muslim , Arnellis , Ahmad Fauzan , Yerizon

1243-1253

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