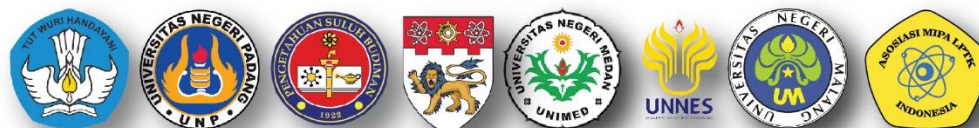




PROGRAM AND ABSTRACT BOOK

THE 4TH INTERNATIONAL CONFERENCE on Research and Learning of Physics (ICRLP 2021)

Flexibility and Innovation on Physics and Physics Education
Research during a New Normal and Society 5.0 Era



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“Flexibility and Innovation on Physics and Physics Education Research During a New Normal and Society 5.0 Era”

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CONFERENCE PROGRAM

The 4th International Conference on Research and Learning of Physics (ICRLP) 2021



Padang, September 1st – 2nd, 2021

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COMMITTEE

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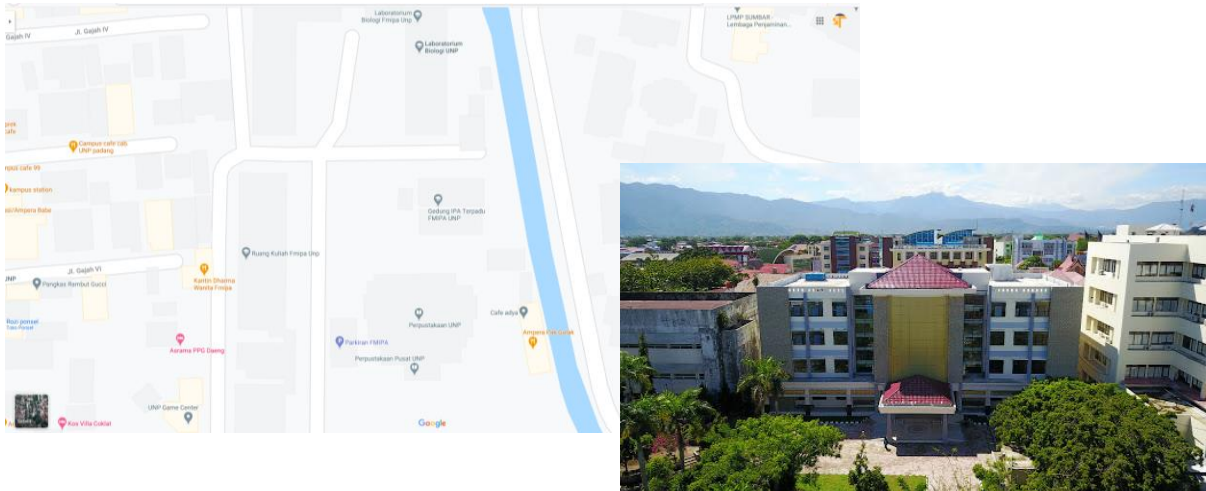
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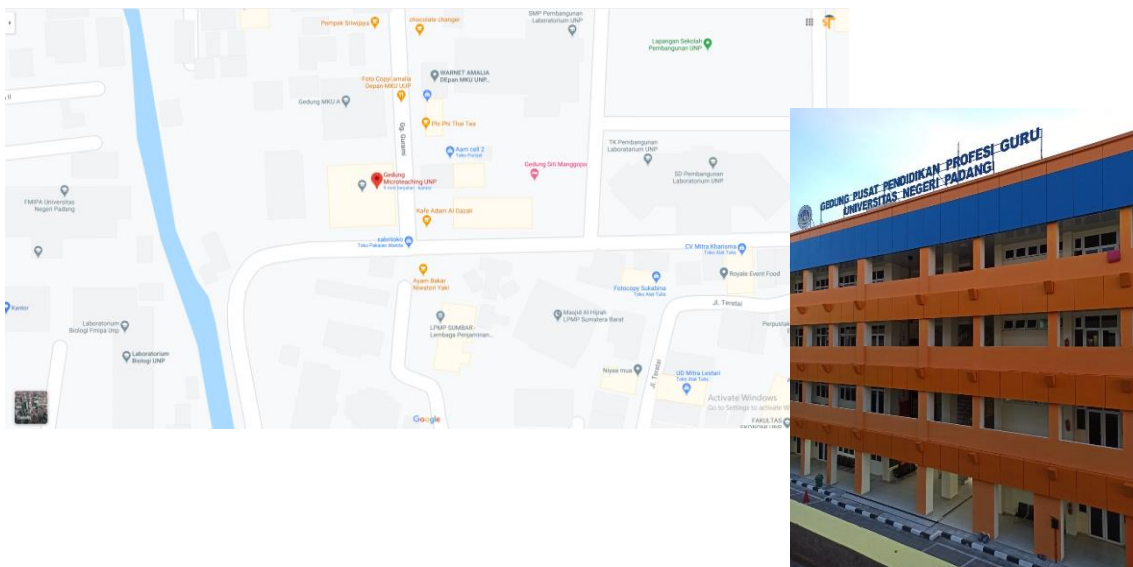
Dra. Murtiani, M.Pd.
Dessupri Niarti, S.Si
Ceng Sri Yunita, S.Si.

MEETING VENUE

Opening Ceremony: Gedung Terpadu Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Negeri Padang



Parallel Session: Gedung Pusat Pendidikan Profesi Guru Universitas Negeri Padang



Online Conference with Zoom Meeting



Meeting ID: 844 0308 3613

Passcode: 112233

WELCOME ADDRESS from General chair of the 4th International Conference on Research and Learning of Physics (ICRLP) 2021

Honorable Rector of Universitas Negeri Padang,
Honorable Vice-Rector of Universitas Negeri Padang,
Honorable Dean of Faculty of Mathematics and Natural Science Universitas Negeri Padang,
Vice-Dean of Faculty of Mathematics and Natural Science, Universitas Negeri Padang
Head of Graduate Program in Faculty of Mathematics and Natural Science
Head of Department in Faculty of Mathematics and Natural Science
Keynote speakers and Invited Speakers
Committee of this conference
Dear participants
Ladies and gentlemen

First of all, I would like to thank each one of you for joining the 4th International Conference on Research and Learning of Physics (ICRLP) 2021. I am very proud to say that this conference has been organized for over three years by the Faculty of Mathematics and Natural Sciences at Universitas Negeri Padang and has been a huge success each year.

I'd like to extend a warm welcome to all of the keynote speakers, invited speakers, and delegates who have taken time out of their busy schedules to join us here today for this conference. We are grateful to have you all here.

I would also like to offer my regards to all committees who made this seminar functional in such hard times. Last year, the theme of the conference was based on global problems, which hugely helped the scientists, researchers, lecturers, and students in inducing a motivation for doing *research even though* the world is *sustained* such as a *Covid-19 pandemic*.

This year, the 4th International Conference on Research and Learning of Physics (ICRLP 2021) will focus on "Flexibility and Innovation in Physics and Physics Education Research in a New Normal and Society 5.0 Era." This topic was brought up because research must continue to be conducted and developed even if the Covid-19 pandemic is not over. As a result, one solution to addressing the limitations of this new normal era is the implementation of research that is flexible while still offering novelty or innovation in the field. Furthermore, as the times change, we are expected to be adaptable, and a concept of a human-centered and technology-based society known as the era of society 5.0 has begun to be applied.

Without any further delay, I would like to start with the events. Please Enjoy the Event!"

Thank you very much.

Dr. Riri Jonuarti, M.Si.

General Chair of ICRLP 2021

**WELCOME MESSAGE from Dean of Faculty of Mathematics and Natural Science
Universitas Negeri Padang**

Honorable Rector of Universitas Negeri Padang,
Honorable Vice-Rector of Universitas Negeri Padang,
Vice-Dean of Faculty of Mathematics and Natural Science
Head of Graduate Program in Faculty of Mathematics and Natural Science
Head of Department in Faculty of Mathematics and Natural Science
Keynote speakers and Invited Speakers
Committee of this conference
Dear participants

Ladies and gentlemen,

First of all, I would like to welcome you all to the 4th International Conference on Research and Learning of Physics (ICRLP) 2021 which is hosted by Faculty of Mathematics and Natural Science. I would also like to express my gratitude to all the keynote speakers who have graciously accepted our invitation to share their knowledge and experience in a variety of expertise. I believe that your keynote speech will give significant contribution for all the audience of the conference. To all speakers and participants, I am greatly honored and pleased to welcome you this conference. This international conference event can be held with the help and cooperation of the committee.

This conference is a special occasion for those who work in physics, physics education, and other related fields. We expect that the conference will enable you to share your research with an international research community and to engage in discussion about the issues relating to research and/or practice in physics and physics education. Hopefully, this conference will contribute for innovation and trend in physics and physics education also other related fields in science and technology for global challenges.

Last but not least, I would like to thank you all participants for attending, paying attention and participating in the conference. I would like to express my gratitude to all sponsors for their full support and contribution to the ICRLP 2021. I also wish to express my gratitude to the Organizing Committee and the Scientific Committee for their diligence and hard work in realizing this international conference in this pandemic.

Thank you,

**Dr. Yulkifli, S.Pd., M.Si.
Dean**

WELCOME MESSAGE from Rector of Universitas Negeri Padang

Honorable Vice-Rector of Universitas Negeri Padang,
Dean of Faculty of Mathematics and Natural Science
Vice-Dean of Faculty of Mathematics and Natural Science
Head of Graduate Program in Faculty of Mathematics and Natural Science
Head of Department in Faculty of Mathematics and Natural Science
Keynote speakers and Invited Speakers
Committee of this conference
Dear participants

Ladies and gentlemen,

First of all, through this welcome speech, I would like to extend my sincere gratitude to all the Dean of Faculty of Mathematics and Natural Science and committee members of the 4th International Conference on Research and Learning of Physics (ICRLP) 2021 who have worked hard and smartly to hold the conference. It gives me great happiness to extend my sincere and warm welcome to the keynote speakers and all participants. On behalf of Universitas Negeri Padang, let me welcome you to this conference which is being held in the era of the COVID-19 pandemic.

I believe that this conference will become a good medium and opportunity for us to communicate and share the newest information about the knowledge, concepts, theories, and result of the research and the most important things are to create networking and to cooperate, collaborate with other participants as well as institutions in national and international scope. On the other hand, through this conference we can improve the quality of our researches as well as innovation and tend in physics and physics education other related fields in science and technology for global challenges.

Last but not least, I would like to thank you all participants for attending, paying attention and participating in the conference. I do hope that all of your papers can be accepted by the publisher. Finally, I wish all participants get a lot of benefits at the conference. Thank you very much.

Thank you,

Prof. Ganefri, Ph.D
Rector

Implementation Regulation of Zoom Meeting on ICRLP

1. Id Participant Name (ROOM_ID PESETA_NAMA)
Ex: 01_001_FANNY
If it does not match, it will be removed from the room
2. Always show your face (video on)
3. If it doesn't match, it will be removed from the room
4. If a participant interferes activities the form of noise then he/she is muted by the Operator automatically
5. If a participant is removed from the room, please re-enter by turning on the video
6. During the parallel session, all participants go to the meeting session in the group provided by the Operator automatically
7. In the second plenary section, the participants returned to the Main zoom automatically
8. Each participant fills in attendance four times during this activity. The attendance link will be shared during the Plenary session and Parallel session

RUNDOWN OF ICRLP 2021

Time	Activity
Wednesday, September 1st, 2021	
07:30 – 08:30 AM	Registration
08:31 – 08:45 AM	The Indonesia National Anthem “Indonesia Raya”
08:46 – 08:50 AM	Recitation of The Holy Qur’an (Video/Live)
	Opening Speech
08:51 – 08:55 AM	General Chair, ICRLP 2021: Dr. Riri Jonuarti, M.Si
08:56 – 09:00 AM	Dean of FMIPA UNP: Dr. Yulkifli, S.Pd, M.Si.
09:01 – 09:10 AM	Rector of UNP: Prof. Drs. Ganefri, M.Pd., Ph.D
09:11 – 09:20 AM	Recitation of the Prayer (Video/Live)
09:21 – 09:30 AM	Photo Session
09:31 – 10:00 AM	Keynote 1: Datuk Prof.Dr. Harith Ahmad
10:01 – 10:30 AM	Keynote 2: Prof. Wilson Agerico Dino
10:31 – 10:45 AM	Break
10:46 – 12:00 AM	Parallel Session 1 (10 room)
12.01 – 01.30 PM	Lunch and Prayer
01:31 – 02:00 PM	Keynote 3: Prof. Fabien Miomandre
02.01 – 02.30 PM	Keynote 4: Prof. Rienk Smittenberg
02:31 – 03:30 PM	Parallel Session 2 (10 room)
03:31 – 04:00 PM	Break
04:01 – 05:30 PM	Parallel Session 3 (10 room)
05:31 – 05:45 PM	Closing by MC
Thursday, September 2nd, 2021	
07:30 – 09:00 AM	Registration
09:01 – 09:30 AM	Keynote 5: Dr. Asrizal, M.Si
09:31 – 10:00 AM	Keynote 6: Assoc. Prof. Dr. Khajornsak Buaraphan
10:01 – 10:15 AM	Break
10:16 – 12:00 AM	Parallel Session 4 (10 room)
12.01 – 01.30 PM	Lunch and Prayer
01:31 – 02:00 PM	Keynote 7: Dr. Caroline Bouvet de Maisonneuve
02.01 – 02.30 PM	Keynote 8: Dr. Nurul Syafiqah Yap Abdullah
02:31 – 03:30 PM	Parallel Session 5 (10 room)
03:31 – 04:00 PM	Break
04:01 – 05:30 PM	Parallel Session 6(10 room)
05:31 – 05:45 PM	Closing Speech by General Chair, ICRLP 2021: Dr. Riri Jonuarti, M.Si

PARALLEL SESSION SCHEDULE OF ICRLP 2021

GROUP 1

Day 1 : 1 Sept 2021			
Time	ID	Name	Title
10.46-11.00	ICR00064	Kartika Hajar Kirana	Application of K-Means Cluster Analysis for Magnetic Susceptibility Zoning of Urban Topsoil in Bandung City
11.01-11.15	ICR00081	Ravidho Ramadhan	Evaluation of GPM IMERG Products for Extreme Precipitation over Indonesia
11.16-11.30	ICR00084	Marzuki	Dynamics of West Coast of Sumatra and Island Arc Mentawai During the Coseismic Phase of The Mentawai Mw7.8 25 October 2010 Earthquake
11.31-11.45	ICR00086	Rizha Rizky Aisyah	Application of seismic refraction method to identify rock layers around the lake body
11.45-12.00	ICR00088	Mariyanto Mariyanto	Analysis of Vibrating Sample Magnetometer (VSM) data of Brantas river sediments using HYSITS
12.01-01.30	Lunch and Prayer		
01:31-02:00	Keynote3		
02.01-02.30	Keynote4		
02.31-02.45	ICR00015	Adree Octova	Ion Sand Modeling Using Geoelectrical Resistivity Method in Ulakan Tapakis Padang Pariaman
02.46-03.00	ICR00148	Adree Octova	Analysis of Physical and Chemical Properties of Iron Sand in Ulakan Tapakis Padang Pariaman
03.01-03.15	ICR00149	Adree Octova	Geological Modeling to Calculate the Resource Estimation of Ion Sand in Ulakan Tapakis Padang Pariaman
03.16-03.30	ICR00175	DWI ANISA VISGUN	IDENTIFICATION OF ROCK TYPES FROM IRON SAND AT PASIA JAMBAK BEACH, PADANG, WEST SUMATERA
03.31-04.00 PM	Break		
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
Day 2: 2 September 2021			
10.16-10.30	ICR00094	Galih Priambodo	Magnetotelluric data analysis using 2D resistivity modelling in Gondang region, Bojonegoro
10.31-10.45	ICR00095	Rizka Amelia	Application of ground-penetrating radar method to detect underground pipes in PAIR BATAN utility area
10.46-11.00	ICR00100	Ahmad Dedi Putra	Fault Zone Identification for Groundwater Flow Assessment Based On Seismic Reflection Survey Data at The Area of Felda Lepar Utara, Pahang, Malaysia

11.01-11.15	ICR00171	Zamri Zainal Abidin	Interferometer Technique and Radio Quiet Zone Characteristics for Radio Astronomy in Tropical Countries
11.16-10.30	ICR00102	Muhammad Archie Antareza	HYSGUILTS: A MATLAB Graphical User Interface (GUI) for hysteresis loop simulation in Vibrating-Sample Magnetometer (VSM) data
11.31-11.45	ICR00105	Djody Virgiawan Ramadhan	Analysis of Isothermal Remanent Magnetization (IRM) data of Brantas river sediments using IRMITS program
11.46-12.00	ICR00113	Helmi Yusnaini	Intraseasonal Change of the Diurnal Cycle of Precipitation Over Sumatra from IMERG Observation
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45	ICR00174	ANISA RAHMI	ANALYSIS MAGNETIC SUSCEPTIBILITY OF IRON SAND PASIA JAMBAK BEACH, PASIA NAN TIGO, PADANG BASED ON DEPTH
02.46-03.00	ICR00101	Dr. Evi Noviani, M.Si	Free surface flow modelling with a submerged obstacle
03.01-03.15	ICR00192	Pakhrur Razi	
03.16-03.30			
03.31-04.00	break		

GROUP 2

Day 1 : 1 Sept 2021			
Time	ID	Name	Title
10.46-11.00	ICR00089	Ledyana Fitriani	Power Setting Based On Load Using Phase Control On Conveyor System
11.01-11.15	ICR00082	Rachid Marzoug	Cellular automata model for car accidents at a signalized intersection
11.16-11.30	ICR00156	Vina Lorenza	Digital Connecting Wheel Motion Experiment System with Remote Laboratory Based on Website
11.31-11.45	ICR00155	Asrizal	Tool Modeling System of Atwood Machine Experiment with Free Fall Remote Control for Tracker Video Analysis
11.45-12.00	ICR00157	Iddya Chazanah	Digital Uniform Circular Motion Experiment System With Remote Laboratory Based on Website
12.01-01.30	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00070	Anton Komaini	Volleyball Smash Test Instrument Design With Sensor Technology
02.46-03.00	ICR00161	Risky Syahputra	pErturbations For coaching implications “ a preliminary study on swinging ARM coordination During Tennis Forehand STROKE

03.01-03.15	ICR00074	Resti Fevria, S.TP, MP	ISOLATION AND IDENTIFICATION OF LACTIC ACID BACTERIA FROM SAUERKRAUT ISOLATE WITH ADDITIONAL CHILLI (Capsicum annum L.)
03.16-03.30	ICR00194	Erdawati	Effect of Spent Coffee Ground Pretreatment with Natural Deep Eutectic Solvent (NADES) on Coffee Oil Yield
03.31-04.00 PM	Break		
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45	Closing		
Day 2: 2 September 2021			
10.16-10.30	ICR00167	Ramesh T Subramaniam	Microcannular Electrode/Electrolyte Interface for Energy Storage Devices
10.31-10.45	ICR00132	Thamil Selvi Velayutham	Electromechanical Properties of Piezoelectric and Ferroelectric Polymers
10.46-11.00	ICR00133	WOO HAW JIUNN	Sodium ion batteries based on Acid-Etched Prussian Blue as positive electrode materials
11.01-11.15	ICR00190	Muhammad Ajriy Ushalli	Solar Charged Controller Instrument with Maximum Power Point Tracking Method Based on Internet of Things
11.16-10.30	ICR00198	Erawati S.Si	Design Analysis, Sensor Response Test and Sensor Performance from Electrochemical Glucose Sensor Articles
11.31-11.45	ICR00256	Zulhendri Kamus	Optimization of Object Injection Current in the Development of Electrical Impedance Tomography for Bone Fracture Detection
11.46-12.00	ICR00185	Media Sentosa	Design Visitor Counter Using RFID Sensor for Monitoring The Number of Tourists
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45	ICR00177	Nita Handayani	Quantitative EEG Analysis for Characterizing Complexity in Autism Spectrum Disorders
02.46-03.00	ICR00183	Washilla Audia	AUTOMATIC TRANSFER SWITCH IN SOLAR CELL INVERTER SYSTEM BASED ON ANDROID APPLICATION
03.01-03.15	ICR00066	Mairizwan	
03.16-03.30			
03.31-04.00			

GROUP 3

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00158	Chew Khian-Hooi	First-principles Density Functional Theory Study of Novel Materials for Energy Storage and Conversion
11.01-11.15	ICR00153	LIM LIAN KUANG	Low Energy Plasma Focus Ion Beam Emission
11.16-11.30	ICR00162	Goh Boon Tong	Synthesis of 1D and 2D Nanomaterials for Renewable Energy Applications
11.31-11.45	ICR00187	Ratnawulan	The Effect of Sintering Temperature on Hydrophobic characteristic of Silica Manganese /Polystyrene (SiMn/PS) Nanocomposite
11.45-12.00	ICR00191	MUHAMMAD SALAM	FABRICATION AND SURFACE CHARACTERISATION ON HYDROPHOBIC MORTAR CEMENT
12.01-01.30	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00251	Oktaviani Syaputri	The Effect of Variation Calcination Temperature of Polystyrene/Tetrahydrofuran (PS/THF) Hydrophobic Layers on Contact Angle and The Compressive Strength of Cement Mortar
02.46-03.00	ICR00083	Elsa Vera Nanda	Characteristic and Photostability of Astaxanthin Extract From Shrimp Shells by Microwave Assisted Extraction Using Nades Solvent
03.01-03.15	ICR00096	George Billy Nanlohy	PyTherNal: A python program for analyzing curie temperature from thermomagnetic data
03.16-03.30	ICR00077	Zulhipri	The effect of Extract Tannins from Spent Coffe Ground on Waste Water Treatment
03.31-04.00 PM	Break		
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45	Closing		
Day 2: 2 September 2021			
10.16-10.30	ICR00176	Ramesh Kasi	Incorporation of Hybrid Corrosion Inhibitor with Epoxy Resin for Enhancing the Performance Properties of Organic Coatings
10.31-10.45	ICR00184	Heejeong Jeong	Cold atom array for Rydberg quantum simulation
10.46-11.00	ICR00075	DR. Vauzia, M.Si	EFFECT OF ADDED ECO-ENZYMES ON CHLOROPHIL LEVEL OF LETTUCE (Lactuca sativa L.) CULTIVATED HYDROPONICALLY
11.01-11.15	ICR00252	Delvi Septiana	Effect of Composition Variation Calcium Carbonate/Polystyrene (CaCo3/Ps) on the

			Contact Angle of the Hydrophobic Layer and the Compressive Strength of Portland Cement
11.16-10.30	ICR00257	Ratnawulan	Effect of SiMn/PS Composition on Hydrophobic Properties of Nanocomposite Thin Layers
11.31-11.45	ICR00151	SITI FAIRUS ABDUL SANI	Low-cost commercial graphite-rich pencils for passive radiation dosimetry
11.46-12.00	ICR00170	MRUTUNJAYA BHUYAN	GW171817 Binary Neutron Star Merger Event: Equation of State of Nuclear Matter at Supranuclear density
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45	ICR00059	Desi Sri Hartaty Gultom	SALMAN'S ENERGY: BUSINESS BRICKET BIOARANG BASED ON PINEAPPLE LEATHER AND GROUND NUT LEATHER
02.46-03.00	ICR00253	Ratnawulan	Effect Of Acid, Salt And Base Immersion On Hydrophobic Properties Of SiMn/PS Nanocomposite
03.01-03.15	ICR00254	Nazein	EFFECT OF COMPOSITION CaCO ₃ /POLYURETHANE (PU) ON CONTACT ANGLE OF THE SURFACE AND COMPRESSIVE STRENGTH OF MORTAR
03.16-03.30			
03.31-04.00			

GROUP 4

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00003	ASPINA SIHABUDDIN	The Identification of Teaching Pattern of Physics Teacher in Level XI Of SMA Negeri 1 Gowa
11.01-11.15	ICR00022	Alfangni Vembrian Mahaputra	The Effect of Active Learning in The Flipped Classroom Learning Model on 6th Grade Science Subjects of Elementary School.
11.16-11.30	ICR00052	Kartini	THE EFFECTIVENESS OF DISCOVERY LEARNING MODEL ON EXOPLANET MATERIALS IN DISTANCES LEARNING
11.31-11.45	ICR00173	Akmam	Need analysis of developing a generative learning model based on cognitive conflict in Computational Physics during the Covid 19 pandemic
11.45-12.00	ICR00116	Muhammad Amirul Bin Rahiman	Development of a Physics Learning Activity for the Topic of Boyle's Law using the STEM Approach
12.01-01.30	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00114	Trio Junira Fernando	THE EFFECT OF GUIDED INQUIRY MODEL WITH A SCIENTIFIC APPROACH IN ONLINE LEARNING ON STUDENTS' COMMUNICATION AND COLLABORATION ABILITY ON HEAT AND THE

			KINETIC THEORY OF GASES LEARNING TOPIC IN GRADE XI AT SMAN 1 HARAU
02.46-03.00	ICR00195	Mrs.Numkang Rattanaphan	The Development of STEEAMS Teaching Unit for Enhancing Grade 10 Students's Creative and Argumentative Skills in the Force Topic
03.01-03.15			
03.16-03.30			
03.31-04.00 PM	Break		
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45	Closing		

Day 2: 2 September 2021

10.16-10.30	ICR00179	Hanival Febryan	Need analysis of project based learning model and portfolio assessment in physics learning
10.31-10.45	ICR00104	Muhamamd Reyza Arief Taqwa	College Students' Conceptual Understanding of Force and Motion: Research Focus on Resource Theory
10.46-11.00	ICR00131	Sithi Vinayakam Muniandy	Museum as An Active Discovery, Learning and Outreach Centre for STEM Education
11.01-11.15	ICR00250	Viki Pratama	Design of Interactive Multimedia Based on Cognitive Conflict on Temperature and Heat Using Adobe Animate CC 2019
11.16-10.30			
11.31-11.45			
11.46-12.00			
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45			
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 5 (Assessment)

Day 1 : 1 Sept 2021

Time	ID	Presenter	Title
10.46-11.00	ICR00122	Mardiyana Binti Zaharuddin	Development of Game-Based Assessment Kit for Topic of Form 1: Light and Optics
11.01-11.15	ICR00018	Sharmila	Integration of Laboratory Activities and Contribution to Results of Learning Physics on the Concept of Fluid in High School Physics Learning

11.16-11.30	ICR00067	Putri Dwi Sundari	First-year evaluation toward the implementation of physics learning online during Covid-19 Pandemic: Students's perceptions
11.31-11.45	ICR00072	RIFATUL MAHMUDAH	Analysis of Physics Learning Difficulties in the Topic of Quantum Phenomena of Madrasah Aliyah Students in Indragiri Hulu
11.45-12.00	ICR00091	Annisa N	Meta analysis of the Effect of STEM-Based Teaching Materials on Students' Literacy and Knowledge Competence in Learning Science and Physics
12.01-01.30	Lunch and Prayer		
01.31 - 02:00	Keynote3		
02.01 - 02.30	Keynote4		
02.31-02.45	ICR00092	Naurah Nazifah	Meta Analysis of the Effect of STEM-Based Modules in Science and Physics Learning on Knowledge and 21st Century Skills of Students
02.46-03.00	ICR00060	Rahmah Evita Putri, M.Pd	Biotechnology Topics Analysis : A Preliminary Study of STEM Based-Science Practicum Book for Secondary School
03.01-03.15			
03.16-03.30			
03.31-04.00 PM			
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45			
Day 2: 2 September 2021			
10.16-10.30	ICR00097	Silmi Hidayatullah	Meta Analysis of the Effect of Guided Inquiry on the Skills of High School Students in Physics Learning
10.31-10.45	ICR00121	Zakirman	The Effectiveness of e-Simulation with Asynchronous Learning Concept to Improving Students Understanding in Physics Education Department FKIP Indonesia Open University
10.46-11.00	ICR00147	Amali Putra	Competency Analysis Model to Develop Dimensions Variation of Knowledge and High Order of Thinking Skill (Hots) In High School Physics Learning Content
11.01-11.15	ICR00182	Edith Allanas	The Effect Integration of a Sustainability-Oriented Socio-Scientific Issue in the Chemistry Learning on Student's Environmental Awareness
11.16-10.30	ICR00080	Putri Nurhaliza	The Analysis of Suitability Level High School Physics Materials with Covid-19 Knowledge for the Development of Research-Based Physics E-Books

11.31-11.45	ICR00103	I Made Astra	Analysis of Distance Learning Physics During the Covid-19 Pandemic
11.46-12.00	ICR00108	Muhamamd Reyza Arief Taqwa	Students' Conceptual Understanding on Vector Topic in Visual and Mathematical Representation: A Comparative Study
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45			
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 6

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00001	Fanny Rahmatina Rahim	Interactive design of physics learning media: The role of teachers and students in a teaching innovation
11.01-11.15	ICR00004	NURUL JANNAH BINTI HOSMAN	The Design and Development of Technology-Embedded Solar Energy STEM (SESTEM) Module among Education University of Sultan Idris (UPSI, Malaysia) Diploma Science Students
11.16-11.30	ICR00005	Muhammad Havid	Validity of student worksheet inquiry based learning model with scientific approach integrated creative thinking skills for grade XI physics learning on 21st century
11.31-11.45	ICR00019	Andi Nisfananda Ekayanti	Development of online learning devices based on project based learning (PjBL) in optical materials
11.45-12.00	ICR00020	Dewi Nurhasanah	QR CODE ASSISTED LEARNING MEDIA ON SKY COORDINATE SYSTEM MATERIALS FOR REMOTE LEARNING
12.01-01.30	Lunch and Prayer		
01:31 - 02:00	Keynote3		
02.01 - 02.30	Keynote4		
02.31-02.45	ICR00024	Muqarrabiin Haqqul Yaqiin	Learning Application Design Using Physicatz of Geography and Science Edition: Solar System for High School
02.46-03.00	ICR00188	Hufri	Practicality of Basic Electronics Module Integrating Creative Thinking in Diode Circuit Material and Its Applicatio
03.01-03.15			
03.16-03.30			
03.31-04.00 PM			
04.01-04.15			
04.16-04.30			
04.31-04.45			

04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45			
Day 2: 2 September 2021			
10.16-10.30	ICR00138	NURUL HAZWANI BINTI ARIFFIN	The Development of "Monoelectric Kit" for the Topic on Series and Parallel Circuits for Secondary School Science and Its Usability among Physics Trainee Teachers
10.31-10.45	ICR00137	Ibnu Hanif Bin Noor Salim	Smartphone-Based Learning Module (Speed Of Sound) In Physics Education: Development, Validity and Perception To Usability Process
10.46-11.00	ICR00134	Nurafiqah Binti Mohamed Azman	PC Sound Card: Transformation to High Technology Physics Experiments
11.01-11.15	ICR00124	Siti Nadia Binti Adnan	The Development of an Interactive Learning Module In The Topic of Transistor and Its Usability Among Physics Trainee Teachers
11.16-10.30	ICR00057	Ihsan Hijria Putra	Student Responses to The Development of Online Learning Device Based Guided Inquiry in Mechanical Waves Matter
11.31-11.45	ICR00140	Faliani Afikah Binti Abd Aziz	The Development of a Virtual Reality Video In The Topic of Magnetism and Its Usability From The Perspective of Undergraduate Science Education Students
11.46-12.00			
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45			
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 7

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00041	Griselda	DEVELOPMENT OF INTERACTIVE LUDO GAMES AS A MEDIA IPBA HIGH SCHOOL LEARNING EXERCISES ON CALENDAR MATERIALS
11.01-11.15	ICR00045	Lila Zalika	Development of Computer Based Instruction (CBI) Learning Device on Solar System Material
11.16-11.30	ICR00046	Raffa Fitra Ramadannisa	Development of Learning Media Using Sketchware on The Topic of New Crescent Moon Observation and Calculation for Undergraduate Students
11.31-11.45	ICR00063	Yopy Mardiansyah	Redesign Accelerated Linear Motion Experiment on Inclined Plane Using Sensors to Improve Conceptual Understanding
11.45-12.00	ICR00085	Anderias Henukh	The Effectiveness of Using Quizizz in Basic Physics Learning in the Era of Covid-19 Pandemic
12.01-01.30	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00087	Wahyuni Satria Dewi	The validity of physics learning evaluation course based on project-based learning and portfolio assessment
02.46-03.00	ICR00200	Renol Afrizon	Validity and Reliability to Instruments of Students Initial Competence for Development of Physics Learning Games Integrated with Scientific Literacy
03.01-03.15	ICR00193	Hidayati	
03.16-03.30			
03.31-04.00 PM			
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45			
Day 2: 2 September 2021			
10.16-10.30	ICR00135	MOHAMMAD DANIAL ASLAM BIN MOHD ASRI	Development And Perception of Usability of Optical Spectrometer Kit as A Teaching Aids for Blackbody Radiation Subtopic Among Trainee Teachers in Universiti Pendidikan Sultan Idris (UPSI)
10.31-10.45	ICR00136	NUR ERYZAWATI BINTI BAJERI	The Development Of An Optic Learning Module Using Genially And Its Usability From The Perspective Of Physics Undergraduates

10.46-11.00	ICR00139	AHMAD FAIZ BIN SHAHARIN	The Development of "Do-It-Yourself" Water Rocket Launcher for Science Trainee Teachers
11.01-11.15	ICR00058	Febi Valentina	Development of the implementation of the learning plan (rpp) is an online entrepreneurship based learning on static fluid materials
11.16-10.30	ICR00051	Kamila Aulia Rahma	DEVELOPMENT OF EDMODO-BASED ONLINE LEARNING MEDIA DEVICES BASED ON MODIFIED FREE INQUIRY (MFI) ON ELECTRIC CIRCUIT MATERIALS FOR REMOTE LEARNING (PJJ)
11.31-11.45	ICR00053	Salsa Ghina Khairunisa	Development of Physics Learning Interactive Multimedia Integrated with Student Worksheets on the Subject of Vibration for High School Students
11.46-12.00			
12.01-01.30			
01.31-02.00			
02.01-02.30	Lunch and pray		
02.31-02.45	Keynote		
02.46-03.00	Keynote		
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 8

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00047	Rizky Yusuf Halomoan	Development of Online Learning Tools Based on Somatic, Auditory, Visual and Intellectual (SAVI) Models in Dynamic Fluid Materials
11.01-11.15	ICR00048	Sifa Nur Safitri	Development of Distance Learning Tools Based on Problem Solving Laboratory (PSL) on Work and Energy Materials
11.16-11.30	ICR00049	Iffah Hamidah	THE POTENTIAL OF USING YOUTUBE AS A LEARNING SOURCE OF GEOTHERMAL ENERGY MATERIALS
11.31-11.45	ICR00115	Rini Amelia	Needs Analysis as a Basis for the Development of POE-Based Physics Learning Tools in terms of Science Process Skills
11.45-12.00	ICR00118	IZNI AQILAH BINTI ROSLI	The Development And Usability of "Bitada" Kit For Linear Motion Topics Among Physics Trainee Teachers
12.01-01.30	Lunch and Prayer		
01:31 - 02:00	Keynote3		
02.01 - 02.30	Keynote4		

02.31-02.45	ICR00119	SITI NUR ANIS BINTI ZAIDI	Development of an Interactive Learning Module for the Topic of Gas Law and Its Usability among Physics Trainee Teachers
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00 PM			
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45			
Day 2: 2 September 2021			
10.16-10.30	ICR00125	FARAH NAJWA BINTI ISMAIL	DEVELOPMENT AND USABILITY OF "GRAVIGAME"™ IN KEPLER'S LAW AMONG PHYSICS TRAINEE TEACHER
10.31-10.45	ICR00127	Nur Shazirah Binti Jasni	The Development and Usability of a Homemade Solar Cooker as a Teaching Aid for Learning Thermodynamics
10.46-11.00	ICR00128	NUR AQILAH AISYAH BINTI SAJRI	DEVELOPMENT AND USABILITY OF JUQUANJI GAME IN QUANTUM THEORY OF LIGHT AMONG PHYSICS TRAINEE TEACHERS
11.01-11.15	ICR00098	Hasbi Azis	Validity of the Physics e-module based on an integrated project based learning model with the Ethno-STEM approach for 11th grade senior high school
11.16-10.30	ICR00099	Khajornsak Buaraphan	The Development of STREAM Teaching Unit for Enhancing Grade 8 Students'™ Creative and Engineering Design Process Skills in the Motion Topic
11.31-11.45	ICR00106	Muhamamd Reyza Arief Taqwa	Integration of Motion Diagram Based Module to Improve Students'™ Conceptual Understanding of 1D Kinematics
11.46-12.00			
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45			
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 9

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00050	Mellyana Mega Hartina	Development of Online Learning Tools Based on Computer Assisted Instruction Material for Newton's Law of Gravity
11.01-11.15	ICR00141	IKMAL HAKIM BIN IBNE WALID	Development of A Free Fall Motion Experiment Based on Smart Phone Using Phyphox Application
11.16-11.30	ICR00169	Shaladsha Irma Halimah	The Development E-Learning Assisted by Flashcard to Improve Students' Scientific Literacy in Senior High School in Gas Kinetic Theory Materials
11.31-11.45	ICR00090	Jirutthitikan Pimvichai	The Development of STEEAMS Teaching Unit for Enhancing Grade 10 Students' Creative and Argumentative Skills in the Force Topic
11.45-12.00	ICR00120	JIM LAU TZE HO	The Development and Usability of a Force and Motion Digital Game using Game-based learning (GBL) among Student Teachers in Malaysia
12.01-01.30	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00123	Silvi Yulia Sari	The importance of e-books in improving students' skills in physics learning in the 21st century
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00 PM			
04.01-04.15			
04.16-04.30			
04.31-04.45			
04.46-05.00			
05.01-05.15			
05.16-05.30			
05.31-05.45			
Day 2: 2 September 2021			
10.16-10.30	ICR00107	Muhamamd Reyza Arief Taqwa	Impact of Computer Assisted Resitation Program on Students' Conceptual Understanding on Static Fluid Topics
10.31-10.45	ICR00109	Vivi Mardian	The Validity of Electronic Learning Material of The Materials Elasticity Properties Integrated STEM to Improve Students' 21st Century Skills
10.46-11.00	ICR00110	Muhammad Dhanil	Design Interactive Multimedia Based on The Cognitive Conflict on Static Fluid Material Using Adobe Animate CC 2019

11.01-11.15	ICR00111	Silvi Yulia Sari	E-books usage by students and educators: A study of perceptions and responses
11.16-10.30			
11.31-11.45			
11.46-12.00			
12.01-01.30	Lunch and pray		
01.31-02.00	Keynote		
02.01-02.30	Keynote		
02.31-02.45			
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00			

GROUP 10

Day 1 : 1 Sept 2021			
Time	ID	Presenter	Title
10.46-11.00	ICR00054	Putri Anjani	The Validity of Learning Implementation Plan of Independent Learning in Online Learning using Direct Learning Models on Thermodynamics Subject
11.01-11.15	ICR00055	Angestu Heriyoso	The Influence of Using Telescopes on High School Students Understanding and Motivation
11.16-11.30	ICR00056	Maulida Rokhimah	Development of Online Learning Tools for Elasticity Materials Using the 7E Learning Model In Class XI Senior High Schools
11.31-11.45	ICR00129	Lau Jia Kit	The Development and Usability of An Experimental Teaching Module on Image Formation by Lens for Pre-service Teachers
11.45-12.00	ICR00130	Nor Sahkkina Binti Kadir	The Development and Usability of Optics Kit as a Teaching Aid among Physics Trainee Teachers
12.01-01.30PM	Lunch and Prayer		
01:31 – 02:00	Keynote3		
02.01 – 02.30	Keynote4		
02.31-02.45	ICR00142	Nabila Anis Binti Zakaria	Developing an Energy Band Gap Model and its Usability from the perspective of Physics Undergraduate Student
02.46-03.00			
03.01-03.15			
03.16-03.30			
03.31-04.00 PM			



Plenary Session

The 4th International Conference on Research and Learning of Physics

Surface as a Playground for Exploring Physical Phenomena and a Foundation for Realizing Designer Materials: Hydrogen-Surface Reaction, a Case Study

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Abstract. “... *He who controls the spice controls the Universe ...*,” declared Baron Harkonnen in the 1984 film adaptation of Frank Herbert’s 1965 novel ***Dune***. But, what is *the spice*? It can *extend youth... prolong life... increase vitality... heighten awareness... catalyze interstellar travel... use to make paper... plastics... cloths... fibers...* It can be anything. We could have replaced *spice* with *energy... catalyst... platinum...* and no one will be any the wiser. Earl Ward Plummer wrote along the same line, “... *whoever controls complex materials controls science and technology*, i.e., progress is *materials-driven...*” Complex materials exhibit startling properties, reveal new and unexpected insights. Development of methods and models to synthesize and simulate complex systems would prove to be extremely useful. But, don’t fall into the trap of developing sophisticated experimental and theoretical techniques becoming an end in itself: one better measurement, one better calculation. Remember Ockham’s Razor? Philip Warren Anderson wrote, “... *a simplified model throws more light on the real workings of nature than any number of ‘ab initio’ calculations ...*, which, even where correct, often contain so much detail as to conceal rather than reveal reality... After all, the perfect computation simply reproduces nature, it does not explain her ...” “*Resources are the enemy of imagination*,” quipped Thomas Delavane in the 2012 TV series adaptation of James Patterson’s 2012 novel ***Zoo***. With these in mind, we take the hydrogen-surface reaction as a case study. At the conference, we will introduce some insights gain from *spice*-related studies, in our quest to Realize Designer Materials utilizing Surface as a Foundation, and explore some physical phenomena along the way.

Keywords: hydrogen, surface, reaction, dynamics, ab initio

Computer-based Learning Module: In the context of Heutagogy

Nurul Syafiqah Yap Abdullah

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Abstract. Over the past decades, drastic advancement in ICTs and IoT have ripples into the world of education which we may not be able to pursue either as educators or students. Rapidly rising cost due to a whirlwind of technological complexity, has broaden the gap between the traditional and the contemporary teaching approaches, as far as the education's concern. Computer-based learning or in short CBL, has been an evolution in teaching and learning. It employs interactive elements of human-computer interfaces via software and applications and has become part of today's educational ecosystem. This was found to be aligned with heutagogy, a self-determined learning concept which makes extensive uses of technology. Hence a CBL module embedded with heutagogy environment was developed, as an effort to a holistic approach in generating student's knowledge. This module was specifically developed for basic electronics topic in pre-university level. The developed module utilizes Phidget Interface Kit and sensors for data acquisition which will be send to personal computer (PC) via Universal Serial port (USB) to represent data interactively on the computer screen as a learning and teaching kit. This was hoped to be a pulse in empowering technology in line with the nation aspirations and vision towards enriching human resources with competitive skill sets to thrive and drive in a global economy and shape our sustainable future.

Hydroclimate Reconstruction using the Hydrogen Isotopic Composition of Leaf Waxes in Lake Sediments

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Abstract. Knowledge of past climate variability is of key importance to gain understanding of the earth's climate system and to test climate models used for predicting future climatic change. Past rainfall intensity, in SE Asia heavily influenced by monsoon strength and the El Nino-Southern Oscillation, can be reconstructed from the hydrogen isotope composition ($^2\text{H}/^1\text{H}$ ratio) of leaf waxes deposited in sedimentary archives like lake sediments. This presentation gives an introduction to the technique followed by a number of applications, with focus on tropical regions.

Keywords: Hydroclimate, Leaf waxes, Hydrogen isotopes, Paleoclimate reconstruction, Monsoon

An updated understanding of Sumatra's volcanic eruption history (Indonesia)

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²*La Statale, University of Milan, Italy*

³*Universitas Negeri Padang, West Sumatra, Indonesia*

Abstract. Improving our knowledge of volcanic eruption histories in Southeast Asia is important for regional hazards. In addition, large volcanic eruptions from Southeast Asian volcanoes have particularly global impacts on climate because they occur in equatorial to tropical regions, releasing ash and aerosols that propagate into both hemispheres. For these reasons, from 2017 to 2020 we visited volcanic deposits throughout Sumatra (North, West and South Sumatra, Jambi, Bengkulu, and Lampung provinces) to reconstruct the chronology and magnitude of volcanic eruptions in the region. We complemented this relatively sparse information with the study of abundant tephra layers preserved in marine cores from the neighbouring Indian Ocean.

Our study of on-land deposits indicates that during the Quaternary the region experienced at least 11 caldera-forming eruptions, in addition to 4 from Toba (between ~1.2 Ma and 74 ka) and 1 from Masurai (~33 ka): 3 from northern Sumatra at ~44 ka (Singkut), ~400 ka and ~580 ka (Hopong-Sapirook), 6 from central Sumatra at ~51 ka (Maninajau), ~400 ka (Diatas), ~150, 210, and 220 ka (Kerinci-Lempur) and 3 from southern Sumatra at ~35 ka (Ranau), ~480 ka (Pasomah), and ~1200 ka (Lampung). Each of these eruptions involved tens to hundreds of km³ of rhyolitic magmas (VEI>6) and produced calderas with diameters between ~5 and 30 km. In addition, older silicic tuffs possibly deposited during large explosive eruptions, have been recognized in northern (Kotoraja, ~ 3 Ma) and southern Sumatra (old Lampung, ~ 6 Ma). The study of marine cores reveals the presence of >25 additional large-scale eruptions with a volcanic explosivity index (VEI) of at least 4 (erupted volumes ≥0.1 km³). Known sources for some of these tephra layers are Marapi, Tandikat, Malintang, and Krakatau but for most layers the source is unknown. Bringing this diverse dataset together shows that (i) North Sumatra is the source of rather infrequent but often very large eruptions (e.g. VEI 8 Toba Tuffs with a periodicity of ~400 ky), (ii) West Sumatra is home to frequent but smaller eruptions (i.e. VEI ~4 eruptions with a periodicity of a few thousand years), while (iii) the South Sumatra – Lampung region is intermediate in eruption size and frequency, although more data is required to confirm this. Such variations in eruptive activity from north to south are likely the effect of geodynamic setting and tectonic configuration.

Functionalization of graphene sheets by metallic nanoparticles : design strategy and electrocatalytic properties.

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Abstract. Graphene is a well-known material with outstanding mechanical and electrical properties among others, but it still suffers from being difficult to obtain and handle as perfect pi-conjugated nanosheets. When synthesized from graphite by thermal treatment, highly reduced graphene oxide is obtained with sufficient conductivity to be used as an electrode material. Further functionalization is however necessary to induce additional properties like energy storage (supercapacitors) or electrocatalysis. To achieve this goal, we proposed to use cycloaddition with tetrazine, a nitrogen-rich electrode deficient small aromatic molecule, which can be grafted in a one step reaction on reduced graphene oxide. The incorporation of nitrogen-rich functions allows further derivatization with metallic nanoparticles, mainly silver or gold, by chemical or electrochemical reduction. This lecture will describe some examples of such design where metallic nanoparticles and nanoclusters are incorporated on graphene sheets after its functionalization by tetrazine derivatives. The new properties of the final nanomaterial in terms of electrochemical energy storage and electrocatalysis will be analyzed on various selected examples.

References :

Y.B. Rus et al. ChemistrySelect 2019, 4, 1298 – 1305; RSC Adv., 2021, 11, 7043.

Development of ACTM of Integrated Science to Improve Digital Age Literacy of Grade VIII Students

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Abstract. The 21st century skills are necessary for students to achieve success in learning, daily life, and their future. For this reason, integrated teaching and integration of literacy in teaching are suitable to handle the challenges of 21st century education. However, the real conditions in school show that there were problems in the implementation of integrated teaching and integration of literacy in science teaching. A solution to this problem was to develop adaptive contextual teaching model (ACTM) of integrated science by integrating digital age literacy. The objective of this research was to describe the opportunities and problems of integrated science teaching and to determine the validity, practicality, effectiveness and effects of the implementation of the ACTM.. This type of research can be classified into research and development. The ADDIE model was used to develop the ACTM and its support system. The research instruments include document assessment sheet, questionnaire sheet, observation sheet, written test sheet, and performance assessment sheet. The data groups in this research were analyzed by descriptive statistics, normality and homogeneity test, paired comparison test, Wilcoxon signed rank test, two-ways analysis of variance, post hoc test, and comparison test of two means. Based on the results of data analysis can be stated three main results of this research. First, the average validity value of the ACTM and its support system can be classified into the very good category. Second, the average practicality value of the use ACTM on science subjects according science teachers and students can be entered into very good category in usable, easy to use, and appealing aspects. Third, the implementation of the ACTM on science subject has given positive effect on ability of students including knowledge, attitudes and digital age literacy skills. In this case, digital age literacy skills include functional literacy, scientific literacy, and visual literacy. The results indicate that science teachers can implement ACTM to develop students' abilities. In addition, this research still provides a good opportunity to develop integrated science learning by developing learning models, ICT-based teaching materials, integration of society 5.0 and literacy 4.0, and so on.

Keywords : Model of Teaching, Contextual Teaching, Integrated Science, Digital Age Literacy

Recent advances in mode-locked fiber lasers using Mxenes and MaxPhase 2D materials as saturable absorbers.

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Scientific argumentation in physics education of Thailand: A lesson learned

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Abstract. One important feature of scientific inquiry is scientific argumentation. There is a relationship between the level of scientific argumentation skill and scientific understanding. Science learners are, therefore, aimed to be able to utilize their scientific knowledge to generate scientific argumentation through cognitive processes and communicate with their peers and teacher. The author reviewed the literature related to scientific argumentation in the physics education of Thailand. In promoting physics students' scientific argumentation, the researchers employed the specific pedagogical approaches as: the Socio-scientific Issue (SSI), Scientific Inquiry (SI), Science-Technology-Society (STS), Context-based Learning and Cooperative Learning. Some authors in the recent years tried to mix more than one pedagogical approach to promote physics students' scientific while others tried to create their own new pedagogical model. Anyway, all of them claimed that the chosen or created pedagogical approaches were significantly effective in promoting students' scientific argumentation. Regarding the dependent variable, most of the studies tried to develop students' scientific argumentation skill; however, the remaining aimed to study the relationship between the level of scientific argumentation skill and other variables e.g. conceptual understanding and reasoning ability. At final, some gaps from the literature are identified and some suggestions are emerged for further study in the educational contexts of Thailand and other countries.

Keyword: Scientific argumentation, physics education, science education, Thailand

ABSTRACT COLLECTIONS



Abstract Collections

The 4th International Conference on Research and Learning of Physics

Interactive design of physics learning media: The role of teachers and students in a teaching innovation

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Abstract. This paper reports how potential users are involved in the design of interactive learning media. This paper describes the responses of teachers and students about how learning media are applied in schools, a detailed description of the desired learning media and how learning media contribute to improve student learning outcomes. This research used quantitative and qualitative methods. The instruments were questionnaires and interview sheets for teachers and students. The data from research instruments of students include learning styles, responses to using learning media in the classroom, and responses to HOTS (High Order Thinking Skill) questions. While the data from the teachers included their activities in the opening, core, and closure activity. In general, the media was expected to increase the enthusiasm and motivation of students in learning. For this reason, learning media that contains challenging questions and multimedia that attract students' attention are developed based on media development indicators.

Keywords: learning media, physics, interactive, teaching, innovation

**The Identification of Teaching Pattern of Physics Teacher in Level XI SMA Negeri 1
Gowa**

Aspina Sihabuddin, 2017

Thesis Faculty of mathematics and sciences. Makassar State University.

Abstract. This research is a descriptive qualitative that aims to know the teaching pattern of learning theory and physics teacher who supports the teaching pattern of physics teacher. This is a case study research. Also, data collection techniques are used namely observation, recording of the learning process and interview. The results of this research show that the pattern of teaching of teacher such as Readiness, Stimulus, Explain, Reward, Recitation, Reflection. Based on the pattern, it can be related with the Bugis-Makassar attitude such as Sipakatau', Sipakalebbi', Mali-Sipareppe', Rebba Sipatokkong, and Sipakainge'. The learning theory that support is the theory of behaviorism, cognitivism, humanism, and gestalt.

Keywords: *The teaching phase, the teaching pattern, local wisdom, learning theory*

The Design and Development of Technology-Embedded Solar Energy STEM (SESTEM) Module among Education University of Sultan Idris (UPSI, Malaysia) Diploma Science Students

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Abstract. The purpose of this study is to design and develop a Solar Energy STEM module (SESTEM) among a class of 80 diploma science students in the Faculty of Science and Mathematics, Universiti Pendidikan Sultan Idris (UPSI). The method of the students' perceptions evaluations of the complete SESTEM module was based on questionnaires and open-ended questions. The module implements fully hands-on activities with the use of technologies such as smartphones, QR codes, images, and videos. This work was based on the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional model. The findings showed that students gave positive feedback regarding the contents and the activities implemented in the module. In a conclusion, SESTEM can be considered as a modern teaching tool, enhancing more value-added skills and can be inured in the future.

Keywords: Solar Energy, STEM Education, Physics Education, Technology Acceptance Model

Validity of student worksheet inquiry based learning model with scientific approach integrated creative thinking skills for grade XI physics learning on 21st century

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Abstract. One of the success factors of learning is the use of learning resources in the form of worksheets that are able to guide students in investigating and solving problems. Choosing a model and approach that is integrated with the ability to think creatively is also another factor that also supports the success of learning. Based on the analysis of student needs and characteristics, as well as the limitations of previous validation studies, an inquiry-based learning model with scientific approach integrated creative thinking skills can be a problem solution. The purpose of this study was to produce worksheets based on an inquiry-based learning model with scientific approach integrated creative thinking skills in the valid category. The research method used is descriptive statistics. The instrument used was a validation sheet that was filled in by the experts. The validity of the worksheets is obtained from the feasibility of the content, presentation, language and graphics components. The average validation of the LKS for the four components was 0.83 by development experts. Therefore, a worksheet based on an inquiry-based learning model with scientific approach integrated creative thinking skills is produced, the ability to think creatively in the valid category.

Keywords: *IBL, Worksheet, Scientific, Creative, Physics Learnig*

Ion Sand Modeling Using Geoelectrical Resistivity Method in Ulakan Tapakis Padang Pariaman

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Abstract. There is no doubt about the presence of iron sand around the west coast of West Sumatra. Several studies have been carried out [1][2][3][4][5][6], but in Ulakan Tapakis area is still under observation, and no investigation of its potential and distribution that has been carried out. One of the methods that can provide models and subsurface descriptions is using the resistivity geoelectrical method. The electricity injection response to the subsurface will get the respective material types under the sounding point. The geoelectrical application at Ulakan Tapakis was used Wenner array into 5 section. The section was designed perpendicular to the beach with a length of 200 meters, the distance between sections was about 65 meters. The results obtained in the form of pseudosection types. Each section describes the distribution and lithology of rocks below the surface. The combination of all sections gives an overview of the iron sand model at Ulakan Tapakis.. From the model obtained, iron sand is spread from the surface to a depth of 1.5 meters in almost every section.

Keywords: Geoelectrical, Resistivity, Wenner, Ion Sand, Modeling

Integration of Laboratory Activities and Contribution to Results of Learning Physics on the Concept of Fluid in High School Physics Learning

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Abstract. Laboratory activities are must be implemented in high school physics learning so that learning is carried out contextually based on observation. The problem faced in high school physics learning is that the laboratory activities have not been optimally carried out with unsatisfactory learning outcomes. This study aims to determine the effect of integration of laboratory activities on the achievement of high school physics learning outcomes in class XI Adabiah High School Padang. The study was conducted for the concept of fluid in the form of quasy experimental research with the post test control only group design. The sampling technique used is cluster random sampling. The research data were in the form of an understanding of physical concepts which were captured using LKPD and post test. The results showed that the average value of the experimental class was higher than the value of the control class. Furthermore, from the regression analysis, the correlation between LKPD scores and post test obtained 31% of LKPD contributions to student learning outcomes. In conclusion, there is a significant influence of the application of laboratory activities on student learning outcomes.

Keywords: Integration of laboratory activities, Student competency, Physics education, LKPD, Fluid

Development of online learning devices based on project based learning (PjBL) in optical materials

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Abstract. In the 21st century Science and Technology (IPTEK) is developing very rapidly, including in the aspect of communication. This is closely related to everyday life because of the use of technology as a tool that makes human work easier. Long distance communication is commonplace in this era. Currently due to the COVID-19 pandemic, student learning is being carried out online using one of the online media, namely Google Meet. So with this technological advancement, learning can be done anywhere and anytime. The purpose of this study was to develop online learning tools or lesson plans using the Project Based Learning (PjBL) learning model on optical materials. The method used is ADDIE (Analysis), Design (Design), Development (Development), Implementation (Implementation), and Evaluation (Evaluation). After going through the process of validation and testing on students, the results of the development of this learning device are valid so that they can be used.

QR CODE ASSISTED LEARNING MEDIA ON SKY COORDINATE SYSTEM MATERIALS FOR REMOTE LEARNING

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Abstract. The occurrence of the Covid-19 pandemic case that was detected in Indonesia, caused the government to impose activity restrictions, one of which was learning activities in schools by closing activities in schools, thus requiring the occurrence of a distance learning system using an online learning system or also called distance learning. So, to support the distance learning process, internet facilities are used to support learning. This study discusses whether there is an increase in learning carried out by students on the use of multimedia assisted by QR code on the material eye of the sky coordinate system which in its implementation uses the google meet platform. Researchers used experimental research methods using pretest and posttest to find out whether there was an increase in learning in the material of the sky coordinate system in distance learning before and after using multimedia assisted by QR code. Based on the results of the evaluation that had been carried out on 10 students of SMA Negeri 51 Jakarta using the pretest and posttest, the average pretest results were 78.00 and the average posttest results were 87.12 using the Paired sample T-test. It can be concluded that there is a difference in the average learning outcomes between the pretest and posttest, meaning that there is an increase in learning in the material of the sky coordinate system after using multimedia assisted by QR code. This online learning tool can be said to be very good and suitable for use in the material of the sky coordinate system. So, multimedia assisted by QR code is effective and suitable for the learning process of the sky coordinate system.

Keywords: distance learning, QR code, coordinate system

The Effect of Active Learning in The Flipped Classroom Learning Model on 6th Grade Science Subjects of Elementary School.

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Abstract. The government's policy to implement the online learning during COVID-19 pandemic caused many problems in schools, including the lack of effectiveness of learning communication, exhausted students, so many teacher assignments, and the complaints about quotas and internet networks. In an emergency situation, teachers must act quickly so that learning can run effectively. Cell phones that were originally only as a communication medium, are now multifunctional, for example, in providing materials and assignments in a very short duration. Using the flipped classroom as an alternative learning model during this pandemic is considered appropriate because this learning model can combine internal learning in the classroom with distance learning at home and also the main goal of maximizing the achievement of learning activity goals. Therefore, this study aims to design a flipped classroom or inverted classroom learning model to be applied on 6th grade Science subject of Elementary School. This type of research is a quasi-experimental design with a non-equivalent. Control group using post-test to be analyzed. The results of this study are the e-learning media supporting the flipped classroom approach that is validated with a good level of feasibility for use during a pandemic like now, as well as the results of trials The field shows that the flipped classroom approach with e-learning does not improve learning outcomes compared to the constructivist approach without e-learning when the two approaches use an active learning process, the increase in student learning outcomes in the two approaches is the effect of active learning instruction compared to the order of instructor participation in the learning process.

Keywords: flipped classroom, e-learning, active learning, science, primary school

Learning Application Design Using *Physicatz* of Geography and Science Edition: Solar System for High School

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Abstract. A brand new comprehensive education application by *Physicatz* in the edition of the science of solar system has been developed and tested in a teaching-learning activity in SMAN 30 Jakarta Timur on 09 April 2020. The purpose of this research is to find out: The effect of using this comprehensive application for instructional activity on students' physical cognitive ability. The reason why this application is so special is because of its comprehensive features. This application's features consist of a magnificent 3D solar system reading material, an interactive quiz, exercises, and a video-based comic that will take us to explore the solar system. The method used in this research was ADDIE Instructional Design (ID) methods with steps: (1) Analysis, (2) Design, (3) Develop, (4) Implement, (5) Evaluate. This research was tested on 100 SMAN 30 Jakarta Timur tenth grade students. This application has been tested through validity examination and received an average percentage of 83,44% from the subject matter expert, 92,31% from the learning resources expert, and 91,97% from the subject matter teacher. The students also took part in the test of using this application to learning Earth and Space Science: the solar system, and received an average percentage of 91,99%.

Keywords: *application, earth and space science, education application, exercises, interactive quiz, physical cognitive ability, physicatz, solar system, video based comic, 3D solar system reading material*

DEVELOPMENT OF INTERACTIVE LUDO GAMES AS A MEDIA IPBA HIGH SCHOOL LEARNING EXERCISES ON CALENDAR MATERIALS

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Abstract. Enrichment was specific activity given to the students who reached the minimal proficiency criteria. One of the method that was able to attracted student's motivation to learn something is by combining learning and playing (edutainment). Application of media that applied edutainment to the enrichment processed can increase student's motivation to develop their knowledge. This reseach was designed to know the media development process, feasibility, practicality, and the student's response to interactive ludo game which developed as enrichment media. The method used is Research and Development (R & D) with ADDIE Model (Analysis, Design, Development, Implementation, and Evaluation). The subjects were matter expert, media specialist, and 20 students of XI grade Indonesia Maju Senior High School have obtained material calendar on earth and space sciences. The data collection instruments in this research is using study paper of specialist material and media, paper of practicality test, and a student questionnaire responses. The result of research showed validation specialist material given a score of 82,7%, a media expert validation of 80,2%, a practicality validation of 83,4%, and student's response amounted to 85,6%. Overall obtained a score of 82,9% so it can be categorized as very worthy and excellent.

Keywords: Encrichment media, interactive ludo game, calender.

Development of Computer Based Instruction (CBI) Learning Device on Solar System Material

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Abstract. Learning devices are media for educators to convey various information in the learning process according to the needs of students. The purpose of this research is to develop interactive learning tools for independent learning based on CBI (Computer Based Instruction) on the material of the solar system at Junior High School 7 Tangerang and to find out the feasibility of interactive learning devices with Computer Based Instruction. This research is useful for developing interactive learning tools whose usefulness can help students learn the material of the solar system better. This research is a research development (R&D) adapted from the ADDIE (Analysis, Design, Development, Implementation and Evaluation) development model, but it is only implemented until the development stage. The feasibility assessment was carried out by two materials experts, two media experts, two learning experts and one science subject teacher. The data collection technique in this research used a questionnaire distribution, then analyzed with descriptive quantitative and qualitative method. The level of feasibility from the research result of learning with a score interval of $3.40 < X \leq 4.20$. The results obtained from this research are the average validation score: 4.52 (very feasible) from material experts, 4.56 (very feasible) from media experts and 4.27 (very feasible) from learning experts and the total average validation result is 4.45 with very feasible category. So, with a Computer Based Instruction (CBI) based learning devices on the material of the solar system for 8th grade Junior high school, it is feasible to use as a learning device.

Keywords: computer-based instruction, learning devices for independent learning

Development of Learning Media Using Sketchware on The Topic of New Crescent Moon Observation and Calculation for Undergraduate Students

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Abstract. The purpose of this research was to develop a learning media in a form of android application using Sketchware for students of Department of Physics Education in Universitas Negeri Jakarta taking Earth and Space Sciences course. This application was developed as there was still very few variations of learning media utilizable to support learning of Earth and Space Sciences (ESS) in Universitas Negeri Jakarta. Based on need analysis, the favoured topic to develop the application was the concept of ijtimak of hilal as a part of the topic of new crescent moon observation and calculation (Rukyat dan Hisab Hilal). This research used the method of ADDIE model for research and development. This research was done through five stages. On the first stage, questionnaire was issued to the students of Department of Physics Education for needs assessment. The second stage, design of broad guidelines of media content for android application development guidance such as flowchart and storyboard were made. The broad guidelines made was to fit curriculum, materials, and learning objective analysis. The third stage was the development of prototype and media validation by chosen experts. The next stage was small group testing experiment which involved 15 participants of students, followed up with bigger group testing experiment which involved 40 students as participants. The last stage was evaluation and final product. The media validation of this application by chosen experts and the reception from the students have been verified as "Very Valid".

Development of Online Learning Tools Based on Somatic, Auditory, Visual and Intellectual (SAVI) Models in Dynamic Fluid Materials

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Abstract. This research aims to develop Online Learning Tools Using Somatic, Auditory, Visual and Intellectual (SAVI) Models on Dynamic Fluid materials. Online Learning was developed to make it easier for students to carry out the learning process during the Covid-19 pandemic. SAVI is a doctrinal reformer that emphasizes that learning must utilize all the sensory tools that learners have. The subjects of this study were Dynamic Fluids on the Principle of Continuity, Bernaulli's Principles, and Toriceli. This research method uses addie model with the following steps: *Analyzing, Designing, Developing, Implementing, and Evaluating*. This research was conducted in MA Al-Bustaniyah Cilegon. Validation is done by 3 experts, namely media experts, material experts, learning experts. The subject was tried in class XI MA as many as 21 students. Data collection instruments using questionnaire guidelines through google form. The results of this study obtained learning tools (RPP, LKS and Online Media) that have been tested for feasibility by experts and field trials with good criteria and worth using.

Keywords: *Online Learning Tools, SAVI Model, Dynamic Fluids.*

Development of Distance Learning Tools Based on Problem Solving Laboratory (PSL) on Work and Energy Materials

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Abstract. Teachers or educators can develop learning tools to deliver materials according to the characteristics of the material, because not all material can be delivered in the same way or method. In certain situations there are times when learning cannot be done directly in the classroom. So the teacher or educator must adjust online teaching and learning activities or distance learning (DL). Efforts to support DL go well, then teachers or educators must prepare supporting learning tools. The learning can be practical so that the learner is more interesting and fun. Problem solving laboratory (PSL) is a learning model that uses problems as the basis of learning that must be solved through practical activities in the laboratory. The syntax of the PSL model is 1) Opneing moves, 2) Middle Game, and 3) End Game. The research method used is ADDIE (Analysis, Design, Development, Implementation, Evaluation). This study aims at learning tools that support practicum-based DL by applying the PSL learning models so that students can find material concepts independently. Validation results by material experts were 89%, learning experts were 87%, and material experts were 82%. So from the results of validation by experts and trials to students obtained that the learning tools that have been developed are worth using.

Keywords: distance learning, problem solving laboratory, ADDIE, work and energy

THE POTENTIAL OF USING YOUTUBE AS A LEARNING SOURCE OF GEOTHERMAL ENERGY MATERIALS

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Abstract. Geothermal is one of the most talked about renewable energies. However, there are still many who are not familiar with geothermal energy, including high school students. Many factors influence this so that the lack of enthusiasm for high school students to know more about geothermal energy. By using Youtube as a source of learning about geothermal energy, knowledge about geothermal energy for high school students will increase. This study aims to see the potential use of Youtube as a learning resource for geothermal energy with the research method used in this study is a survey method with the aim of exploration, using a survey method with the aim of obtaining information from respondents, from the results of the study showed that 62% High school students already use Youtube as a source of their own study materials, with the most supportive factor in using Youtube as a learning resource are teachers who do not hesitate to suggest using Youtube as a learning resource as stated by 74% of respondents

Keywords: Energy, Geothermal, Youtube

Development of Online Learning Tools Based on Computer Assisted Instruction Material for Newton's Law of Gravity

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Abstract. In the emergency period of the spread of Covid-19, the distance learning process was carried out to provide a meaningful learning experience for students without being burdened by demands to complete all curriculum achievements for class advancement as well as activities and assignments according to interests and the conditions of each and the product of home learning activities are given feedback and are useful to the teacher. This study aims to develop an online learning tool based on Computer Assisted Instruction. The CAI model uses computer assistance in its implementation. The steps in CAI, namely preparing teaching materials from the internet, preparing teaching materials using computer software (software), delivering material using CAI media, directing students in learning to become active and creative students, and directing students to make conclusions in the learning process. The research method used is Research and Development (R & D) using the ADDIE model which consists of five stages, namely: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. This online learning tool was developed using e-learning media, namely the web based students worksheet. This Computer Assisted Instruction-based online learning tool has been tested on a limited basis for tenth grade students of SMA Muhammadiyah 1 Depok. The data was collected by distributing questionnaires based on the grid made using google form, starting from the stage of analyzing teacher-student needs, validating 3 experts, testing by teachers and documentation. The validation results were obtained by 80% from material experts, 82.875% from media experts and 82.42% from learning experts. Based on the analysis of the data that has been collected, it can be concluded that online learning tools based on Computer Assisted Instruction on Newton's Law of Gravity are very good and feasible to develop.

**DEVELOPMENT OF EDMODO-BASED ONLINE LEARNING MEDIA DEVICES BASED ON
MODIFIED FREE INQUIRY (MFI) ON ELECTRIC CIRCUIT MATERIALS FOR REMOTE
LEARNING (PJJ)**

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Abstract. The development of technology in the learning process encourages the creation of various online-based learning media, one of which is Edmodo. Edmodo can help teachers build virtual classes according to classroom learning conditions based on real class divisions at school, which contain discussions, quizzes, and assignments at the end of each lesson. By applying the model to *Modified Free Inquiry* (MFI) Edmodo online learning media, interactions, and communication in the classroom can be shaped like conventional classrooms. The purpose of this study was to develop online learning media tools assisted by the Edmodo application in the physics material of electric circuits with the learning model *modified free inquiry* (MFI). The research method used is *Research and Development* (RnD) with the development process using the 4D model, consisting of *define, design, develop, and disseminate*. The data collection instrument involved 2 material validators, 2 media validators, and 2 learning validators and the teacher's response was tested. This study shows that the validation results and teacher responses are obtained with an average percentage of the assessment of 83%. Based on the results of research and discussion can be concluded that online learning media device based Edmodo assisted MFIs are categorized as valid and feasible to use.

Keywords: Edmodo, MFI, ODL, electrical circuits

THE EFFECTIVENESS OF DISCOVERY LEARNING MODEL ON EXOPLANET MATERIALS IN DISTANCES LEARNING

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Abstract. Advances in exoplanet research need to be balanced with basic skills in analyzing laws relating to the solar system. In the revised edition of the 2013 Curriculum, material on analyzing laws related to the solar system is available in class X Basic Competency 3.8 and Basic Competency 4.8. This study discusses the effectiveness of the Discovery Learning model on exoplanet material in online learning using the Zoom Cloud Meeting application. Law number 20 of 2003 explained that distance learning is a teaching activity where participants students and teachers are implemented separately as a process learn to use various sources of learning through technology. In this study, using a pre-test and post-test to determine the effectiveness of the discovery learning model on exoplanet material in online learning. This research method uses experimental methods and uses a qualitative approach. The descriptive type of qualitative method was chosen in this study to collect data about the actual conditions. Data collection techniques in this study used a pre-test and post-test to determine the extent of discovery discovery learning model on on exoplanet material in distance learning. The analysis used in this study was the paired samples T-test. Based on the results of the evaluation that was carried out on 20 students of SMA Negeri 51 Jakarta using the pre-test and post-test, it was found that there was an effectiveness of the Discovery Learning model on exoplanet material in distance learning.

Keywords: discovery learning, exoplanet, distance learning

Development of Physics Learning Interactive Multimedia Integrated with Student Worksheets on the Subject of Vibration for High School Students

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Abstract. Physics materials about vibration often seem abstract to students. It is necessary to have learning media that can explain vibration concepts to answer the student's abstractness problem. The learning media application in this study contains competencies, material, sample questions, learning videos, and interactive evaluation questions. This research uses Research and Development (R&D) method with the development process using the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. ADDIE model for this development research is carried out only up to the Design stage because the objectives of this research and development are: (1) designing interactive multimedia-based physics learning media; (2) determine the feasibility of designing interactive multimedia-based physics learning media. These worksheets have been valid by two media expert validators, two material expert validators, and one teacher. The average score of the validations is 89,89% with a valid category. These results show that the design of worksheets is valid to be used as an alternative learning media for physics materials about vibration.

Keywords: Physics Learning, Interactive Multimedia, Integrated, Student Worksheets, Vibration

The Validity of Learning Implementation Plan of Independent Learning in Online Learning using Direct Learning Models on Thermodynamics Subject

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Abstract. One of the development of online learning tools needed in the implementation of distance learning at home is to prepare a Learning Implementation Plan (RPP) for independent learning. The learning model that can be used to activate students in online learning is the direct learning model. This study aims to know the validity of online learning tools in the form of RPP of independent learning on Thermodynamics subject using the direct learning model. Type of this research is research and development which refers to the 4-D model are define, design, develop, and disseminate. The research instrument used in this study was a validation sheet for media experts, material experts, and learning experts. The validity test of data were obtained from the results of filling out the validity questionnaire conducted by the experts and then analysed by a likert scale. The results of the validity test for RPP of independent learning based on the direct learning model on Thermodynamics material as a whole obtained a percentage of validity from media experts by 88%, material experts by 91%, and learning experts by 92% while based on likert scale interpretation, RPP of independent learning was included in criteria very feasible to use. Based on the results of research and discussion, it can be concluded that the development of RPP of independent learning on Thermodynamics subject using the direct learning model can be applied in physics learning conducted online.

Keywords: *Learning implementation plan of independent learning, thermodynamics subject, direct learning model*

The Influence of Using Telescopes on High School Students Understanding and Motivation

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Abstract. A study on the use of telescopes has been carried out on high school students. The purpose of this experiment is to determine how much impact the use of a telescope has on student understanding and motivation. Were used the earth telescopes or familiar terrestrial in this experiment. The result of this experiment were considered satisfactory because they succeeded in increasing student understanding and motivation.

Keywords : Telescope, earth, students

Development of Online Learning Tools for Elasticity Materials Using the 7E Learning Model In Class XI Senior High Schools

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Abstract. The COVID-19 pandemic has an impact on the education sector. Educators must ensure learning activities continue. The solution is that educators must design learning devices with innovative learning models. The 7E learning model consists of 7 stages, namely: elicitation, engagement, exploration, explanation, elaboration, evaluation, and extension. This study aims to produce independent learning tools for online learning to support distance learning programs. This type of research is Research and Development and was developed using the ADDIE model which consists of five stages, namely: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. The results of the research are in the form of independent learning lesson plans with online interactive learning using the 7E learning model. This product has been validated and is suitable for use as an alternative media for learning physics in schools with the validation results of 81.6 from material experts, media experts give an average score of 87.1% and learning experts give an average score of 86.7 %.

Keywords: elasticity, 7E learning model, learning tools

Student Responses to The Development of Online Learning Device Based Guided Inquiry in Mechanical Waves Matter

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Abstract. Online learning is an interactive activity (Educator-computerized-learners) with virtual application devices. This online learning has been developed in the concept of mechanical wave with Guided Inquiry learning model and scientific approach in the form of teaching device such as Learning Implementation Plan (RPP), Student Worksheets (LKS), assessment design, materials and sample questions. Implementation of the online learning uses virtual media, they are Google Classroom, YouTube, PhET Simulations, and Zoom for face-to-face distance learning, at the Senior High School. The purpose of this research is to describe the necessary and feasibility of online learning device based guided inquiry by exploring students' responses developed to face the education challenges of 21st century on global pandemic era in remote areas with a research model 4D development. Assessment of the feasibility of the device is carried out by the validator experts with an average score is 81.9% for media, the category is very good, learning is 75.0%, good category, and 82.5% for material, very good category. This research was applied to 57 students. The result, stated the learning device with positive responses from students 81.12%, very good category. This means that students can follow by using and simulating online learning experiments. So, it is stated that the online learning device based guided inquiry in mechanical waves matter are deemed appropriate and required by students to support distance learning.

Keywords: Student responses, online learning device, guided inquiry, mechanical waves.

Development of the implementation of the learning plan (rpp) is an online entrepreneurship-based learning on static fluid materials

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Abstract. This research is motivated by the problem of the large number of physics teachers who have not implemented the 2013 Curriculum learning method and the learning lesson plan. This study aims to produce a Physics Lesson Plan (RPP) model based on Entrepreneurship Based Learning on Static Fluid Material for students of Public High School 6 Karawang which can be used as a learning resource for teachers. This research is a Research and Development (R & D) research through validation conducted by curriculum experts and material experts. RPP developed and tested on 7 high school teachers in Karawang Regency. The data analysis technique used quantitative descriptive analysis on the results of the validation score. This study produced a Physics Lesson Plan (RPP) model based on entrepreneurship based learning on Static Fluid Material for students of Public High School 6 Karawang. With the assessment presentation from 2 curriculum experts of 79% (good), 80% of material experts (good), and 78.6% of teacher trials (good), the results of the research on the Physics RPP model based on entrepreneurship based learning on static fluid for students of Public High School 6 Karawang in the final product the results were 79.2%, namely (good).

Keywords: RPP, Entrepreneurship Based Learning, Static Fluid Material,

SALMAN'S ENERGY: BUSINESS BRICKET BIOARANG BASED ON PINEAPPLE LEATHER AND GROUND NUT LEATHER

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Abstract. Activated carbon is carbon that has been activated by a chemical at high temperatures so that it has a higher absorption capacity than ordinary carbon. Activated carbon can be made from a material that has the element carbon. One of the materials that can be made carbon is pineapple skin. Pineapple peel is a waste that is still underutilized by the community. Pineapple skin content such as cellulose, hemi cellulose and lignin which have the potential as adsorbent. So that the skin of the pineapple fruit can be used as a staple in making bioarang briquettes. In making bioarang briquettes made from pineapple skin waste mixed with peanut shells, this is carried out through socialization and training activities to the community in making briquettes with the aim of providing new knowledge and skills in making alternative fuels, namely briquettes, providing alternative solutions to overcome environmental problems. through processing pineapple skin waste into briquette products. The implementation method includes the planning stage, the implementation stage which includes socialization and training and the evaluation stage. The target consumers of this briquette product are the people around North Jakarta, Koja District in fulfilling their daily needs as a substitute for fossil fuels which are increasingly expensive and can be distributed through restaurants, angkringan and traditional markets.

Keywords: briquettes, pineapple skins, effort

Biotechnology Topics Analysis : A Preliminary Study of STEM Based-Science Practicum Book for Secondary School

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Abstract. The purpose of this study is to analyze biotechnology topics for the STEM based-science practicum book. Preliminary study is need to be done before further research, especially for research and development or quasi experiment research. Biotechlogy is one populer topic from secondary school. Biotechnology constitutes a scientific study in science and technology which experiences rapid growth in recent years. The result shows that biotechnology topics contain four basic element to learn science such as fact, concept, princple and procedural. Biotechnology topic also had A₁ until A₅ level of affective skill and C₁ until C₄ level of knowledge skill and also P₁ until P₄ level of psychomotor skill. Every skill level on biotechlogy topic shows compability with the STEM framework. Biotechnology topics also led to a lot of integrated practicum activity especially for student in secondary school. Therefore, biotechnology topics is a compability topic for STEM Based-Science Practicum Book.

Keywords: Biotechnology, STEM, Practicum Book, Secondary School, STEM Based

Redesign Accelerated Linear Motion Experiment on Inclined Plane Using Sensors to Improve Conceptual Understanding

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Abstract. This study aims to create an accelerated linear motion experiment tool on an inclined plane that is more precise using photodiode and infrared sensors as timer based arduino programming. After analyzing the results of tool testing, improvements are made based on the advantages and disadvantages of the tool. Then the tool is used by students to experiment with variations in angle, distance, and mass. Data collection was carried out 5 times for each variation. The tool is innovated by displaying a graph of distance against time, and speed against time using visual basic programming. The implementation of the tool was carried out on students from two different universities with a quasi-experimental method of one group pre-test-post-test design to compare the level of conceptual understanding of students before and after conducting experiments using the designed tools. To measure the level of students' conceptual understanding used instruments that have been designed and validated.

Keywords: Inclined plane, rolling motion, conceptual understanding, sensor, arduino

Application of K-Means Cluster Analysis for Magnetic Susceptibility Zoning of Urban Topsoil in Bandung City

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Abstract. Bandung is one of the metropolitan cities in Indonesia which has a dense population. As a result, the number of vehicles is increasing, which causes an abundance of particulates on the urban topsoil. Motor vehicle particulates can be identified through the value of magnetic susceptibility. The greater the magnetic susceptibility value on the topsoil, the more magnetic minerals are associated with the number of particulates produced by motor vehicles. To zone the value of magnetic susceptibility in an area, a clustering method is needed. In this study, magnetic susceptibility zoning analysis was carried out using the K-mean cluster method. The data processing results on 38 samples divided into three clusters showed that 12 samples were in cluster 1, 23 samples were in cluster 2, and 3 samples were in cluster 3. The samples in each cluster were influenced by the magnetic susceptibility value between the sample centre and the neighbouring samples and are determined by the distance between the centre of the cluster sample and the neighbouring sample. The validation of the clustering results is shown through the F test, which shows that the calculated F is greater than the F table at a significance level of 0.05. So it can be said that there is an association between the magnetic susceptibility values in a cluster.

Keywords: K-mean cluster, magnetic susceptibility, urban topsoil

First-year evaluation toward the implementation of physics learning online during Covid-19 Pandemic: Students' perceptions

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Abstract. Due to the spread of Covid-19 in Indonesia, learning practices have changed from face-to-face learning to online learning, including higher education. The implementation of online learning at university has been accomplishing for approximately one year. This research focused on the perceptions of students toward physics learning online. As many as 198 students from three departments in the Faculty of Mathematics and Natural Sciences at Universitas Negeri Padang act as respondents. The data was obtained from an online survey using the Google Form. The results showed that most students had negative perceptions about the implementation of physics learning online. Although students thought online learning was the best solution during the Covid-19 pandemic. However, most of the students complained about the workload given by the lecturers and the limited feedback given regarding assignments. Lack of convenience, effectiveness, and difficulties during one year of online learning implementation could act as positive feedback for the university to improve the quality of online learning in the future. Therefore, online learning is more beneficial for students.

Keywords: students perceptions, online learning, evaluation, Covid-19 pandemic

Volleyball Smash Test Instrument Design With Sensor Technology

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Abstract. The purpose of this study was to make a prototype of a sensor-based Smash Athlete volleyball skill test instrument. This research is a development research with a model design adapted from Borg & Gall. The process of developing a volleyball athlete's Smash skill test instrument was carried out through the first stages, namely looking for potential problems, data collection, product design, design validation, and design revision. In determining the validity of the tool, it is carried out by conducting expert validation consisting of Evaluation and Measurement Test experts, Volleyball Experts, and Instrumentation physicists. Expert validation test with questionnaire assessment in order to obtain an average validity of 94% with the category "Very Good. This concludes that the volleyball smash instrument test tool is good for measuring volleyball smash skills.

Keywords: Instrument, smash, Volleyball, Sensor

Analysis of Physics Learning Difficulties in the Topic of Quantum Phenomena of Madrasah Aliyah Students in Indragiri Hulu

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Abstract. This study aims to identify the extent to which and what factors influence the learning difficulties experienced by class XII students in studying physics, quantum phenomena. For this purpose, we have surveyed 180 class XII students of MAN 1 Indragiri Hulu, Riau, Indonesia, as respondents. The survey was conducted by evaluating the respondents' formative test results on quantum phenomena in the last three years and followed by interviews. Based on the analysis of the formative test data, it was found that 58% of respondents had learning difficulties in the very high category. Judging from understanding the concept of quantum phenomena which includes sub-topics: Black Body Radiation, Wien Shift Law, Photon Energy, Photoelectric Effects, Compton Effects, and X-Rays, the results of data analysis show that respondents' mastery is below 30%. Meanwhile, based on interviews that have been conducted with some randomly selected respondents, it was found that the factors of respondents' learning difficulties on the topic of Quantum Phenomena include: the topic is abstract, the teacher does not use engaging media and supports understanding, and the teacher's teaching style is less variety.

Keywords: learning difficulties, students' difficulties, quantum phenomena, physics, survey

**ISOLATION AND IDENTIFICATION OF LACTIC ACID BACTERIA
FROM SAUERKRAUT ISOLATE WITH ADDITIONAL
CHILLI (*Capsicum annum* L.)**

Abstract. Identification of isolates was carried out macroscopically and microscopically, macroscopically by looking directly at the morphology of bacterial isolates growing on the medium (Ibrahim et al. 2015), the observed characteristics of the colonies were colony shape, edge shape, color and surface shape (Romadhon et al. 2012), while microscopically it was carried out by the gram staining method and the type of fermentation test. Sauerkraut (suerkhol) is the result of lactic acid fermentation from chopped white cabbage with a length of about 20 cm and a width of 2 mm to 5 mm. (Fevria, R. 2019). Lactic acid bacteria have an essential role in almost all food and beverage fermentation processes, such as dairy products and probiotic drinks such as yogurt. then p enelitian aims to mengisolasi dan identifying Lactic Acid Bacteria (LAB) of Isolates Sauerkraut with the addition of chilli based gene *16S* rRNA. Isolation of LAB from Sauerkraut was isolated by pour plate method using MRSA (*Man Ragosa Sharpe Agar*) selective medium. Furthermore, morphological characterization, biochemical tests and molecular tests were carried out. This research is a descriptive research that will be conducted in May-August 2021 at the Biology Laboratory of the Faculty of Mathematics and Natural Sciences, Padang State University. Bacterial identification was carried out by PCR and sequencing methods on the *16S* rRNA *gene*. Sequencing will be carried out at the Biotechnology and Genetics Laboratory, Department of Biology, UNP with an automated DNA sequencer (ABI Prism 3100 Genetic Analyzer, Applied Biosystem, USA). Each fragment of the PCR results was sequenced in two directions, using a *forward* primer (27F) and a *reverse* primer (1492R). The results of the sequencing were analyzed with BioEdit software and then assembled into a single nucleotide sequence of the *16S* rRNA *gene*. The standard sequence that will be used is the *16S* rRNA *gene sequence* from NCBI.
Keyword : Sauerkraut, BAL, Isolate, Sequencing

EFFECT OF ADDED ECO-ENZYMES ON CHLOROPHYLL LEVEL OF LETTUCE (*Lactuca sativa* L.) CULTIVATED HYDROPONICALLY

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Abstract. Chlorophyll is a pigment that gives green color to the leaves and stems of a plant. Chlorophyll is very important in the process of photosynthesis in addition to it u chlorophyll also contain high antioxidant, anti-inflammatory and a wound healing substances. Chlorophyll is found in many green vegetables, especially lettuce . Lettuce leaves contain lots of vitamins, protein, calcium, phosphorus, sitosterol and minerals, especially iron which are useful for the growth and health of the human body. Lettuce can be cultivated hydroponically and non-hydroponically. In a preliminary study conducted in December 2020, it was found that the comparison of the chlorophyll content of lettuce cultivated in hydroponics was lower than the chlorophyll content of lettuce cultivated conventionally. The purpose of this study is: to know influence ecoenzyme addition to the chlorophyll content of lettuce grown hydroponically . Eco-enzymes are the result of the fermentation of organic kitchen waste, sugar. and water with a ratio of 3:1:10, which can accelerate bio-chemical reactions in nature to produce enzymes that are useful in the utilization of fruit or vegetable waste. This research was conducted at the Wire House and Plant Physiology Laboratory, Department of Biology, Padang State University in April - August 2021 . This study was an experimental study , the design used was a completely randomized design with 4 treatments (addition of 1 ml, 2 ml, 3 ml, and 4 ml of ecoenzymes in 1 L of water) and 2 replications. , analysis of chlorophyll content was carried out by Spectrophotometric Method. From the research that has been done, the results obtained that the average content of total chlorophyll content in mg/L in lettuce with the addition of ecoenzymes that are cultivated hydroponically is P1 (control) 3,181, P2, 5, 739, P3, 6,151 and P4, 6,755 . The conclusion of the research was that the total chlorophyll content of lettuce cultivated hydroponically increased numerically with the addition of chlorophyll , but statistically, the addition of ecoenzymes had no significant effect at the 5% level.

Keyword : Lettuce, Chlorophyll, Hydroponics, Eco-enzyme, Spectrophotometry

The effect of Extract Tannins from Spent Coffe Ground on Waste Water Treatment

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Abstract. Green extraction processes to obtain high value bioactive compounds from raw natural materials and wastes has gained attention the past few years. In the present study, we investigated a Natural Deep Eutectic Solvent derived from two natural products, namely choline chloride and glucose as a potential solvent for the extraction of tannin compounds from spent coffee ground(SCG). A tannin was used as coagulant with the Poly aluminium chloride(PAC). as flocculant. Initially, jar test experiments were conducted with a varying dosage of coagulant and initial pH. Next, tests were carried out with different values of PAC dosage, flocculation time as well as sedimentation time to find out the optimum condition for colour removal. The supernatant layer of treated leachate from each test was analysed for colour, , pH and conductivity. At optimum leachate pH of 5, experiments with 3 minutes flocculation time and sedimentation time of 10 minutes resulted in the highest colour removal (81.8%) at coagulant dosage of 100 mg/L, with 1 mg/L PAC being added. Coagulation flocculation system of OF as tannin-based coagulant with PAC as flocculant showed the promising result in decolourisation of wastewater.

Keywords : NADES, Tannin, coagulation-flocculation, wastewater

The Analysis of Suitability Level High School Physics Materials with Covid-19 Knowledge for the Development of Research-Based Physics E-Books

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Abstract. Mitigation of the COVID-19 disaster is very important considering that Indonesia and various countries in the world are currently under the threat of COVID-19. West Sumatra is a province affected by COVID-19 with a high threat, especially in the Padang city. One of the efforts to break the chain of the spread of COVID-19 is by conducting online learning by incorporating knowledge of COVID-19 in learning Physics. Thus, COVID-19 is no longer a threat but can be a source of learning for students. However, until now how the level of compatibility of physics material with knowledge of COVID-19 is not known. This type of research is descriptive research with a qualitative approach. The population of this study is all high school physics material and taking samples of high school physics material for 3 consecutive semesters based on the 2013 curriculum. The research procedure includes: 1) preparation stage, 2) implementation stage, 3) completion stage. At the preparatory stage carried out, namely preparing a research design, determining the subject and object of research, preparing instruments, testing the validity of the instrument, analyzing the results of the validity test, and making improvements to the instrument. The procedure carried out at the implementation stage is to collect data by analyzing the level of conformity of physics material with knowledge of COVID-19. Several procedures were carried out at the completion stage, namely processing data, drawing conclusions and reporting research results. The expected result of the research is the level of conformity of physics material with knowledge of COVID-19. The implication of the research is that the most appropriate physics material with the knowledge of COVID-19 is obtained for further research, namely the development of the Physics e-book.

Keywords: Suitability level, Physics material, COVID-19 knowledge, Physics E-book, Descriptive research.

Evaluation of GPM IMERG Products for Extreme Precipitation over Indonesia

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Abstract. Accurate information on extreme rain is essential for vulnerability analysis and early warning systems of hydrometeorological disasters. One newly launched satellite that can provide information about extreme precipitation is the Global Precipitation Measurement (GPM), which produces half-hour grid data through the Integrated Multi-Satellite Retrieval for GPM (IMERG) system. This work evaluates the performance of IMERG data to measure extreme precipitation indices over Indonesia. Three types of GPM IMERG data: IMERG-Early, IMERG-Late, and IMERG-Final, were validated by rain gauge data in Indonesia for extreme rain indices from 2016 to 2019. Overestimated values for extreme precipitation indices were dominated by low-intensity precipitation such as PRCPTOT, R1mm, and CDD indices. On the contrary, underestimated values of extreme precipitation indices dominated by high-intensity precipitation such as R90p, R95p, R50mm, and RX1day indices. Moreover, the different types of IMERG data showed a similar pattern with slightly different values for identifying extreme precipitation indices. Thus, a more comprehensive study is needed to improve GPM IMERG in observing the extreme precipitation over Indonesia.

Keyword: GPM, IMERG, rain gauge, extreme precipitation, Indonesia.

Cellular automata model for car accidents at a signalized intersection

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Abstract. In this paper, we developed a two-lane cellular automata model to explain the relationship between car accidents at a signalized intersection and traffic-related parameters. It is found that, the increase of the lane-changing probability increases the risk of accidents, besides, the inflow α and the probability of accidents exhibit a nonlinear relationship. Furthermore, depending on the inflow, exhibits three different phases. The transition from phase I to phase II is of first (second) order when $\alpha > 0$). However, the system exhibits a second (first) order transition from phase II to phase III when $\alpha < 0$. In addition, when the inflow is not very high, the green light length of one road should be increased to improve the road safety. Finally, simulation results show that the traffic at intersection is safer adopting symmetric lane-changing rules than asymmetric ones.

Keywords: Two-lane intersection; Accidents; Fatality risk; Lane-changing; Phase transition.

CHARACTERISTIC AND PHOTOSTABILITY OF ASTAXANTHIN EXTRACT FROM SHRIMP SHELLS BY MICROWAVE ASISSTED EXTRACTION USING NADES SOLVENT

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Abstract. This study aims to determine the effect of temperature and light UV on the color photostability of astaxanthin microcapsule. Astaxanthin from shrimp shells, extracts by microwave assisted extraction using NADES as the solvent. The optimal conditions obtained were, a microwave power of 180 W, an extraction time of 5 minutes, and ratio NADES shrimp shell powder 8: 1 mL/g with yield astaxanthin of 7,466 ppm. Astaxanthin is purified using petroleum ether and dehydrated with anhydrous natrium sulfite. The purification results showed an increase in the brightness of the astaxanthin color, expressed in L * 48.70 and an h value of 73.12. In order to maintain their photostability color, astaxanthin is encapsulated with nano chitosan. The astaxanthin microcapsules were characterized by SEM, EDX, FTIR, and XRD, for chemical structure, morphological, and crystallization observation. It was reported that a photostability astaxanthin microcapsule was slightly enhanced. The test results showed that the color of the astaxanthin microcapsules did not change after 30 minutes of UV exposure. The heat resistance test also shows that at 200° C the color of astaxanthin microcapsule turns brown due to the solvent and the water in the astaxanthin microcapsule evaporates.

Key word: MAE, NADES, shrimp shells, astaxanthin, encapsulation

Dynamics of West Coast of Sumatra and Island Arc Mentawai During the Coseismic Phase of The Mentawai Mw7.8 25 October 2010 Earthquake

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Abstract. Sumatra is located at the top of Sunda Megathrust, a large subduction zone where Eurasian continental plate subducts beneath the Indo-Australian ocean plate. This mechanism provide a high potential of small to large scale earthquake and numbers of following hazard. On October 25, 2010, a Mw7.8 earthquake near Mentawai occurred and followed by a tsunami. The dynamics of Mentawai Islands and West Coast of Sumatra was observed before, during and after the rupture using the Global Positioning System (GPS) technology, widely known as the Sumatran GPS Array (SuGAR) network. RINEX data from several SuGAR's stations in Mentawai (BSAT, SLBU, PRKB, SMGY, KTET, PPNJ) and West Coast of Sumatra (LNNG, MKMK, LAIS, MNNA) was processed using GAMIT/GLOBK software to obtain the coseismic deformation data. In the preseismic phase (30 days before the earthquake) no anomalies were found that could be used as precursors for the earthquake. The largest deformation was observed at the BSAT station in Bulasat, Mentawai as a 28.36 cm southwestward coseismic jump and the coseismic jump at the stations in the Sumatra (LNNG, MKMK, LAIS, MNNA) was below 3 cm toward the same direction. During the 30 days after the earthquake the plate relaxation at the postseismic phase was observed and seems to require some period of times to recover to its normal deformation trend. This shifted postseismic trend is indicated by change in the direction of plate movement compared to the preseismic trend.

Keywords: Earthquake, Sumatra, Deformation, GPS, SuGAR.

The Effectiveness of Using Quizizz in Basic Physics Learning in the Era of the Covid-19 Pandemic

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Abstract. This study aims to describe the effectiveness of using Quizizz in basic physics online learning activities in terms of learning outcomes and student responses. The research was conducted at Musamus University in the odd semester 2020/2021 academic year. This type of research used a mixed method. The subjects in this study were 59 students who took basic physics courses. The instruments used in this study were multiple-choice questions, student response questionnaires, and interview guide sheets. The results of this study indicate that the percentage of students' complete learning outcomes in basic physics courses is 79%. In addition, 14.3% of students said they strongly agree that Quizizz is effective in learning and 85.7% say that they agree. The learning outcomes obtained are also supported by the results of interviews which state that students are very happy and motivated in participating in basic physics learning because learning using Quizizz makes them feel that learning is interesting and increases their interest in listening to basic physics learning materials so it can be concluded that the use of Quizizz in Basic physics learning in the Covid-19 pandemic era has very high effectiveness.

Keywords: Quizizz, Physics Learning, Covid-19

Application of seismic refraction method to identify rock layers around the lake body

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Abstract. The objective of this study was to identify the lithological layer around the lake body in order to determine the ability of the reservoir body structure to withstand surrounding seepage water. This research was conducted using the MAE X820S seismic instrument, carried out on a 46-meter-long track and 24 geophones. Seismic refraction processing is done by picking at the first break in each seismic trace. The first break is the first seismic wave recorded by a geophone. From the picking results, distance and time parameters will be obtained so that a seismic velocity model can be generated to be analyzed for lithological types based on the P-wave velocity. The results of the processing show that this research area consists of two rock layers, including the first layer with P wave speeds ranging from 648.11 m/s - 711.32 m/s with a depth of 0-19 m, interpreted as sand-gravel. The second layer has a P wave velocity of 1553.21 m/s with a depth of 19-30 m, interpreted as a layer of clay. Rock layers that have a sand-gravel lithology have the ability to seep or pass water, while layers that have a clay lithology cannot pass water. Therefore, the first layer is thought to have a less strong ability to withstand surrounding seepage water.

Keywords: lake body, P-wave velocity, rock layer, seepage water, seismic refraction

The validity of physics learning evaluation course based on project-based learning and portfolio assessment

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Abstract. Physics Learning Evaluation course aims to develop students' knowledge and skills in conducting assessments that are implemented at schools in the form of case studies or project assignments. However, the difficulty of implementing a contextual evaluation to real conditions was the main problem for students. In addition, it was difficult to find evaluation that can be used as project assignments. On the teacher's side, the project assignments produced by students had not been fully assessed by appropriate assessments taking into the preparation, process and results stages. Project Based Learning (PjBL) is a suitable model to train students' independence in constructing learning through project assignments. The study aims to develop teaching materials of Physics Learning Evaluation based on PjBL and using the portfolio assessment. The study used the ADDIE model with 5 stages, namely: analyze, design, develop, implement, and evaluate. The validation of these teaching materials was part of the develop stage, which was carried out after the teaching materials were developed. The results showed that the teaching materials of Physics Learning Evaluation based on PjBL and using portfolio assessment was valid that they can be used in learning

Keywords: teaching material, physics learning evaluation, project based learning, portfolio assessment

Analysis of Vibrating Sample Magnetometer (VSM) data of Brantas river sediments using HYSITS

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Abstract. Several vital activities in East Java are supported by the Brantas River, ranging from irrigation, supply of water raw materials, to industry. Along with the growing population, has the potential to increase the pollution that occurs in the Brantas River. One method that can be used to characterize magnetic minerals in river sediments is VSM. Most studies show VSM analysis based solely on hysteresis curve graphs. Therefore, a deeper VSM analysis needs to be carried out to characterize the magnetic properties. VSM data was taken from the measurement results in the Brantas River sediments. In this study, the HYSITS program is used to provides a deeper and better analysis and interpretation. The results show that HYSITS produces 2 curves besides hysteresis loop graphic, namely the ΔM curve and the first derivative of ΔM curve. Both curves can validate magnetic domain types and magnetic mineral types without susceptibility calculations. Result of the analysis indicates that the magnetic minerals in Brantas River are normal type and strongly suspected to represent ferrimagnetic minerals with Pseudo-Single Domain (PSD).

Keywords: Vibrating Sample Magnetometer (VSM), Magnetic, Sediment, Brantas river, HYSITS

Power Setting Based on Load Using Phase Control on Conveyor System

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Abstract. Conveyor devices have been a part of industrial activity, especially in the material handling sector. The advantage of using conveyors that have been successfully designed through this research is in the power settings based on the load's condition. The conveyor's speed control system used the PWM (Pulse Width Modulation) method, a pulse width setting to supply current for the engine. Inputs come from a Load cell sensor that measures the weight together with the motor's activator. Microcontroller ATmega328 is used as a controller of the system. When the system is activated, the controller will activate the motor activator with the PWM signal based on the load weight. The Microcontroller then identifies the load weight and determines the PWM count to set the corresponding power and speed. Through the optocoupler, Microcontroller provides the pulse to control the gate on the TRIAC (Triode for Alternation Current), which acts as a phase controller connected to the induction motor to power the conveyor. The result of this research shows that the heavier the load is, the generated power will correspondingly be higher.

Keywords: Load cell, Microcontroller ATmega328, Phase Control, PWM, TRIAC.

The Development of STEEAMS Teaching Unit for Enhancing Grade 10 Students' Creative and Argumentative Skills in the Force Topic

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Abstract. This study aimed to develop the STEEAMS (Science-Technology-Engineering-Environment-Art-Mathematics and Society) teaching unit for enhancing grade 10 students' creative and argumentative skills. The researchers intensively reviewed the literature related to the theoretical frameworks of STEAM and STSE. Then, the STEEAMS pedagogical steps were synthesized with their descriptions. There were eight pedagogical steps of STEEAMS i.e. a) Explore basic information about learner; b) Introduce content by using the issue linked to science, mathematics, technology, society and environment; c) Search; d) Consider the appropriate choice and analyze and design, product; e) Create works to integrate art; f) Exchange experiences; g) Summary and evaluation; and h) Expand knowledge and connect to society and the environment. The researchers utilized STEEAMS in designing the five lesson plans for teaching the force topic. The implications of STEEAMS for teaching physics were finally discussed.

Keywords: STEEAMS, STEM, Force, Argumentation, Creative Thinking

Meta analysis of the Effect of STEM-Based Teaching Materials on Students' Literacy and Knowledge Competence in Learning Science and Physics

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Abstract. 21st century education requires students to have literacy skills, broad insight, manage and solve problems in life. STEM education provides opportunities for teachers to guide students in facing the challenges of 21st century education. For this reason, STEM integrated teaching materials are needed, especially in learning science and physics. However, the integration of STEM in teaching materials has not been implemented properly in schools. The solution to overcome these problems is to analyze the effect of STEM-based teaching materials on literacy and knowledge in science and physics learning. The purpose of this study is to see the effect size of STEM-based teaching materials in terms of education level, types of teaching materials, science subjects, physics learning materials, literacy, and knowledge competence. This type of research is meta-analysis. The research data were obtained from 20 national and international articles, as well as international proceedings. Based on the results of the study, it can be seen that STEM-based Physics teaching materials are more effectively used at the high school level for Hooke's Law materials with electronic teaching materials. The results of data analysis also revealed that STEM-based teaching materials has a significant influence on the literacy and knowledge competence of students.

Keywords: Meta-analysis, Teaching Materials, STEM, Literacy, Knowledge Competence

Meta Analysis of the Effect of STEM-Based Modules in Science and Physics Learning on Knowledge and 21st Century Skills of Students

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Abstract. The industrial revolution 4.0 requires students to have 21st century skills. These skills include critical thinking and problem solving, creativity and innovation, communication, and collaboration. The development of 21st century skills can be carried out in all disciplines, especially in both science and physics learning. One of the appropriate methods to use is to apply STEM (Science, Technology, Engineering and Mathematics). STEM indicators in learning can be integrated in a learning material in the form of a module. Modules can be presented in both printed and electronic forms. This study analyzes the effect of STEM-based modules in science and physics learning on the knowledge and 21st century skills of students which determined through effect size. The research data were obtained from 20 national and international journals. The analysis is based on the category of education level, the type of learning material and the physics and science subject matter. The result showed that the STEM-based module was more effective if it was carried out at the high school level with the type of electronic module learning materials. The result of the analysis indicates that the use of STEM-based modules is effective in improving the knowledge and 21st century skills of students.

Keywords: Modules, STEM, Learning on Knowledge, 21st Century Skills

Magnetotelluric data analysis using 2D resistivity modelling in Gondang region, Bojonegoro

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Abstract. Previous studies in Gondang Subdistrict, Bojonegoro Regency have identified underground mud reservoirs that supplies mud volcanoes at the site, which are adjacent to a rock intrusion, as well as other geothermal manifestations in the form of hot springs. Meanwhile, a study using MT method in the zone adjacent to Gondang sub-district has identified a deep fault structure. This study will identify the distribution and characteristics of geological features that are suspected to exist in the area using magnetotelluric (MT) method to further describe the relationship between the geological features related to local geology. MT data measurements were conducted on 7 stations around one line in the north-south direction. The line was then modelled in 2D, using nonlinear conjugate gradient algorithm. The resulting model was used to describe the subsurface resistivity distribution and to identify the geological features. The results show 5 resistive zones ($20-1250 \Omega \cdot m$) and 4 conductive zones ($\leq 10 \Omega \cdot m$). The former consist of 4 vertical zones located middle section, 1 vertical zone at south section deeper than 5 km, and 1 horizontal zone extending along south section near the surface. 2 conductive zones are located near north section, around a resistive zone, while 2 others at south section stretching below the horizontal resistive zone. The vertical resistive zones are interpreted as andesite intrusions, and the horizontal one as volcanic breccia. The conductive zones are interpreted as consisting of tuff and marl with possible saline water content. At least 3 faults are predicted to be around and between the intrusions. 3 intrusions in the middle section are thought to have the same source, and all 4 intrusions are suspected to co-occur with the Pandan Volcano intrusion, along with the Kendeng Zone reversal during Late Pliocene. Unidentified faults in the south section are thought to have been cut off by intrusions.

Keywords: magnetotelluric, 2D resistivity, electromagnetic, Bojonegoro

Application of ground-penetrating radar method to detect underground pipes in PAIR BATAN utility area

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Abstract. Pipeline systems dominate today's urban area landscape in the subsurface. This buried pipeline system will continuously develop as well as the utilities change. The planning for underground pipelines should be done to make no mistakes in the pipeline path. According to that, mapping for the underground pipeline is necessary to obtain a database for any upcoming construction development. This study aims to detect underground pipelines around utility areas using the ground-penetrating radar (GPR) method or so-called georadar. A frequency of 300 MHz was used to acquire GPR data from 5 lines with the total length of each line being 22.6m and spacing for each line is 0.5 m. A sequence of processing stages of the GPR data was conducted using matGPR, a MATLAB-based program. Interpretable GPR profiles from each measurement line are obtained after adjusting signal position, removing DC, Dewow, mean filter, gaining, removing global background, and KL-filter. The results show an obvious amplitude reflection anomaly. Each line has similar detected underground pipes from its vertical axis, so-called the two-way travel time, and horizontal axis (horizontal distance). Clearly, all lines show an obvious contrast anomaly located at the 2.5 m horizontal distance. This most striking anomaly is interpreted as a water tunnel. While the other five anomalies, which have a parabolic-shaped look, were identified as underground pipes.

Keywords: ground-penetrating radar (GPR), georadar, electromagnetic, MATLAB, underground pipe

PyTherNal: A python program for analyzing curie temperature from thermomagnetic data

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Abstract. Thermomagnetic analysis is conducted by cooling and/or heating materials, followed by observing the change of magnetic moment. Performing these would result in obtaining the Curie Temperature of the materials, which is essential in estimating magnetic minerals contained in material samples. This paper introduces PyTherNal (Python Thermomagnetic Analyzer), a thermomagnetic analysis tool in Python environment which is meant to assist in analyzing thermomagnetic data. The advantages of Python over other programming languages, particularly in the functionality and the flexibility of being used in any operating system (OS) became the main reason for the program to be written in Python. PyTherNal is designed to assist in the estimation of Curie temperature of materials through thermomagnetic method, by locating the maximum curvature of the highest value of second (2nd) derivative of both cooling and heating data. To facilitate these, PyTherNal generates three figures, namely the thermomagnetic curve, the 1st derivative curve, and the 2nd derivative curve, with the estimated Curie temperature points for both cooling and heating data attached within each curve. An advantage of the program is that to improve the accuracy of Curie temperature estimation, the program performs smoothing, which is important in reducing the variability of the derivative curve so that the Curie temperature can be estimated correctly. With the program being written in Python, the program itself is open-source so that it is free to use without any license needed. Along with it, it is also applicable and capable of cross-platform.

Keywords: thermomagnetic, PyTherNal, python, Curie temperature, magnetic properties

Meta Analysis of the Effect of Guided Inquiry on the Skills of High School Students in Physics Learning

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Abstract. Education is one of the important things in current government policies. Education is pursued by the government in accordance with the demands of the current era. The current demand for education is the industrial revolution 4.0 where education further enhances student skills. The guided inquiry model is a learning with an inquiry process that has scientific work steps to hone students' skills. Student skills will be seen during the learning process and can be assessed on the effectiveness of the guided inquiry model on student learning outcomes. Researchers analyzed 30 journals that used a guided inquiry model on student skills. The aspects of the skills studied were science process skills, critical thinking, and students' mastery of concepts. The analysis technique used is effect size analysis. The analysis is based on the category of subject matter, class, and the influence of the guided inquiry model on students' skills. The results showed that the guided inquiry model could improve students' skills in learning physics.

Keywords: guided inquiry, effect size, skills

Validity of the Physics e-module based on an integrated project based learning model with the Ethno-STEM approach for 11th grade senior high school

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Abstract. Physics e-module based on an integrated project based learning model with an Ethno-STEM approach for class XI students is needed in the optimal physics learning process. Before using this e-module, it is necessary to test the feasibility of the e-module. Validation aims to determine the e-module is said to be suitable for use in learning. The e-module validation uses the Aiken's V formula by 3 validators. Collecting data using a validation questionnaire which consists of 4 aspects. The first is the feasibility of the content of the e-module with a value of 0.78 with a valid category, the second is the feasibility of e-module construction obtained a value of 0.79 with a valid category, the third is the feasibility of language with a value of 0.75 with a valid category, and the fourth is the feasibility of e-graphical services. module with a value of 0.86 in the valid category. The overall conclusion is that the value of the physics e-module based on the integrated project based learning model with the Ethno-STEM approach is 0.80 with a valid category. So that the e-module is suitable for use in learning physics for 11th grade senior high school.

The Development of STREAM Teaching Unit for Enhancing Grade 8 Students' Creative and Engineering Design Process Skills in the Motion Topic

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Abstract. This study aimed to develop the STREAM (Science-Technology-Religion-Engineering-Art and Mathematics) teaching unit for enhancing grade 8 students' creative and engineering design process skills. The researchers intensively reviewed the literature related to the theoretical frameworks of STREAM. Then, the STREAM pedagogical steps were synthesized with their descriptions. There were six pedagogical steps of STREAM i.e. a) Introduce the STREAM situation; b) Identify the targeted problem; c) Explore and plan to solve the problem; d) Solve the problem and integrate Art; e) Present creatively; and f) Summarize, Apply and integrate with moral. The researchers utilized STREAM in designing the five lesson plans for teaching the Motion topic. The implications of STREAM for teaching physics were finally discussed.

Keywords: STREAM, motion, grade 8, creative thinking, engineering design process skill

Fault Zone Identification for Groundwater Flow Assessment Based On Seismic Reflection Survey Data at The Area of Felda Lepar Utara, Pahang, Malaysia

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Abstract. Geological structures such as faults and fractures have an important influence in the process of fluid movement below the surface. The hydraulic behavior in aquifers can be determined by proper characterization of fractures, fault zones and their connectivity. In this study, we concern on detection and identification of fault zones in the groundwater basin to verify whether faults in the basin area connect to the surface, and whether the fault zones occurring serve as conduits or barriers for groundwater to flow. The seismic reflection method with Common Depth Point (CDP) profiling technique has been applied in this study. Through this study, we have identified that several large and small-scale faults were found in the study area. Generally, this large-scale faults cut the bedrock (granodiorite) up to impermeable layer. This large-scale fault group can be a barrier that block the groundwater flow. The fault zone is connected to the surface as evidenced by the presence of normal fault that is clearly observed at the surface. This seismic method is good to apply in this study because it can be used to record deeper subsurface conditions, especially for fault zone detection purposes.

Keywords: *Aquifer, CDP, Fault Zone, Groundwater, Seismic Reflection*

Free surface flow modelling with a submerged obstacle

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Abstract. A mathematical model of fluid flow and its solution are essential parts of understanding a physical phenomenon. This paper gives a complete derivation of the mathematical model of free-surface flow with a smooth obstacle submerged in the fluid called the Neumann-Kelvin problem. The fluid moves with a uniform constant velocity and is assumed to be incompressible. By using the mass and momentum conservation law, we obtain the incompressible Navier-Stokes equations. Adding the kinematic and dynamic conditions in the free surface, we obtain the free surface Euler's equations. Further, the linearisation of water waves named the Neumann-Kelvin equations is obtained by assuming the fluid to be irrotational and taking the first order of the expanding equations. Simulation shows that solution of the Neumann-Kelvin problem gives a periodic wave downstream.

Keywords: free-surface flow, Neumann-Kelvin Equations, Euler's equations, mathematical model.

HYSGUITS: A MATLAB Graphical User Interface (GUI) for hysteresis loop simulation in Vibrating-Sample Magnetometer (VSM) data

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Abstract. In rock magnetism, Vibrating-Sample Magnetometer (VSM) data displays magnetic moment in specific applied ascending and descending magnetic field, which results in a pattern called hysteresis loop. This loop characterizes different magnetic materials depending on its shape. In recent years, the usage of computer software to analyze hysteresis loop has become necessary due to its precision. Easily executable, intuitive, and user-friendly open-source programs for analyzing VSM data are still not widely available despite the necessary utilization of them. HYSGUITS was designed with this issue in mind to further improve the development of tools in this field. HYSGUITS is a MATLAB Graphic User Interface (GUI) to analyze the hysteresis loop of VSM data. MATLAB is a suitable base for producing this GUI compared to other programming language due to its sophisticated features and clean data visualization. This software is able to visualize hysteresis loop in different ways, mainly through the difference of ascending with descending magnetization value and its 1st derivative. Features such as interpolation and smoothing can be applied to facilitate the analysis. The GUI displays the graph as an interactive plot window which provides a detailed observation on each data points. This article introduces of the functionalities of HYSGUITS and demonstrates its utilization with example use case.

Keywords: magnetic, hysteresis loop, Vibrating-Sample Magnetometer (VSM), MATLAB, Graphical User Interface (GUI)

Analysis of Distance Learning Physics During the Covid-19 Pandemic

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Abstract. This study aims to describe information about distance learning strategies in physics learning during the Covid-19 pandemic at Musamus University in the even semester of the 2020/2021 academic year. This study uses a quantitative descriptive method. The instrument used in this study was a questionnaire in the form of a Google Form aimed at students in the Physics Education study program. The results of this study indicate that as many as 28.1% of respondents answered that distance learning is effective. In addition, 68.8% of respondents answered that distance learning physics that had been implemented was less effective and 3.1% of respondents answered that it was not effective. This happens because of the many obstacles experienced such as financial issues, the difficulty of the internet network, technical problems and inability to use information and communication technology, and the inability to absorb the concepts provided during distance learning properly so that the implementation of distance learning tends to lead to the provision of concepts, assignments or assignments. practice questions, and projects. This is in line with 75% of respondents who answered that they were only given materials and structured assignments and projects during the COVID-19 pandemic.

Keywords: Distance Learning, Physics, Covid-19

College Students' Conceptual Understanding of Force and Motion: Research Focus on Resource Theory

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Abstract. This research is a descriptive study that aims to reveal students' conceptual understanding on the topic of force and motion. In this study, we focus our review on resource theory. This research was conducted on 86 first-year physics undergraduate students. The research instrument consisted of ten reasoned multiple-choice questions that were feasible based on the criteria of validity, reliability, discriminant index, and difficulty index. The data are in the form of quantitative data and qualitative data. Quantitative were obtained from students' conceptual understanding score. Quantitative data were analyzed by determining descriptive statistics to provide an overview of the understanding level of students' conceptual understanding. Qualitative data were obtained from students' reasons. The data were analyzed using the Miles and Huberman technique with the stages of data reduction, data display, and conclusions drawing/verification. We use this data to analyze resources that are activated by students when they answer the questions. The results of the research analysis showed that the students' conceptual understanding was in the low category. Some resources that are activated by students are (1) the direction of the resultant force is in the same direction as the direction of motion, (2) in circular motion, the resultant force is towards the center, and (3) there is a "force" that maintains the movement of objects. Based on the research results, it is important for teachers to teach the concept of force by identifying object interactions, and interpreting $\sum \mathbf{F} = m\mathbf{a}$ in various problem contexts.

Keywords: conceptual understanding, force and motion, resource theory

Analysis of Isothermal Remanent Magnetization (IRM) data of Brantas river sediments using IRMITS program

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Abstract. Pollution is one of the big problems of continuous pollution in the Brantas River. The type of pollution that occurs in the sediment of a river is associated with the characteristics of its magnetic mineral. As one of the rivers that are widely used, it is a strong indication that the type of pollutant in the Brantas River is anthropogenic pollution. One method that can be used to determine the type of magnetic mineral in river sediments is IRM. Isothermal Remanent Magnetization (IRM) is a method used to observe magnetization of materials by applying a DC magnetic field at a constant temperature. This study aims to determine the types of magnetic minerals in the Brantas River sediments as an indicator of anthropogenic pollution. IRM data was taken from the measurement results in the Brantas River sediments. In this study, the IRMITS program is used to provides a deeper and better analysis and interpretation. From the processing results, IRMITS produces 3 graphs, namely the Linear Acquisition Plot (LAP) curve (b) the Gradient Acquisition Plot (GAP) curve; (c) Standardized Acquisition Plot (SAP) curve. The results show that magnetic minerals reach saturation when the magnetic field (B) is above 800 mT, with coercivity ($B_{1/2}$) in the range $0-2 \times 10^{-3}$ and dispersion (DP) at 0. This indicates that the majority of the Brantas River is dominated by magnetite minerals (Fe_3O_4).

Keywords: Isothermal Remanent Magnetization (IRM), Magnetic, Sediment, Brantas river, IRMITS

Integration of Motion Diagram Based Module to Improve Students' Conceptual Understanding of 1D Kinematics

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Abstract. This study aims to see the effectiveness of using motion diagram-based module to improve students' conceptual understanding of 1D Kinematics. We have integrated module in online learning during the COVID-19 pandemic. This research is an experimental research with one group pretest-posttest design. The research was conducted on 36 first year Physics undergraduate students. The research instrument consisted of 14 multiple choice questions. Data analysis was performed using paired sample t-test, N-gain, and d-effect size. The results showed that $t = -47.81$ [$df = 35$; $sig.(2-tailed) = 0.000$] so it can be concluded that students' understanding of concepts is significantly different. The results of N-gain = 0.543 indicate that the increase is in the upper medium category and the d-effect size = 2.189 indicates that the influence of learning has a strong effect on increasing students' conceptual understanding. The results of this study indicate that the use of motion diagram-based module can improve students' conceptual understanding of 1D Kinematics. The students' conceptual understanding that increased the most significantly was related to (1) consistency in interpreting the (+) and (-) signs on velocity and (2) interpreting negative signs on acceleration.

Keywords: Motion diagram based module, conceptual understanding. 1D kinematics

Impact of Computer Assisted Resitation Program on Students' Conceptual Understanding on Static Fluid Topics

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Abstract. A computer-assisted recitation program has been developed to improve students' conceptual understanding in static fluid materials. This program consists of 68 multiple choice questions with direct feedback. This research is an experimental research with one group pretest-posttest design. The subjects consisted of 138 first-year physics students who took the Basic Physics I. The research instrument consisted of 12 reasoned multiple choice questions. Data analysis was performed using paired sample t-test, N-gain, and d-effect size. The results of the study found that the recitation program could significantly improve students' conceptual understanding with N-gain of 0.46 (upper medium category) and a d-effect size of 2.95 (very strong category). The most significant effect of recitation is compare buoyancy forces on similar objects that float, and sink.

Keywords: computer assisted recitation program, conceptual understanding, static fluid

Students' Conceptual Understanding on Vector Topic in Visual and Mathematical Representation: A Comparative Study

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Abstract. This study aims to compare students' abilities in understanding vector topics in two representations, namely visual and mathematical. This is a comparative research. Data were collected by survey. The research was conducted on 191 first-year undergraduate students of physics and physics education. The research instrument consisted of 14 multiple choice questions (7 questions of mathematical representation and 7 questions of verbal representation). Data analysis was performed by determining descriptive statistics and paired sample t-test. The results showed that the students' ability to understand vector concepts with mathematical representations was better than those in verbal representations. Students' mean score in verbal and mathematical representation formats are 33.81 and 59.16. Based on the results of the paired sample t-test obtained $t = -12.96$ and $\text{sig.} = 0.00$. These results indicate that the students' ability to understand vector concepts in verbal and mathematical representation formats is significantly different. This study's results came that students' understanding of vector concepts still depends on the representation of the questions because their understanding is not coherent. Based on these findings, vector learning should be focused on the meaning of vectors in various representations, and connecting the meanings of vector operations in various representations, not only on mathematics.

Keywords: Conceptual understanding, vector, visual and mathematical representation

The Validity of Electronic Learning Material of The Materials Elasticity Properties Integrated STEM to Improve Students' 21st Century Skills

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Abstract : The development of science and technology is marked by the high competition of society in improving quality education. Quality education refers to the curriculum that has been set by the government, namely the 2013 curriculum. Teachers have not provided learning tools that are following the demands of the 2013 curriculum. The learning materials used by teachers are not attractive and do not follow the development of science and technology, and have not integrated STEM, as evidenced by the percentage of availability STEM 48%. Based on the initial observation data, the 21st-century skills of students are in a low category, namely critical and creative thinking skills by 48% and communication skills through writing by 50%. Teachers need learning materials that are practical, attractive, easy to understand, and economical to support the teaching and learning process. The purpose of this research was to determine the validity of developing STEM integrated electronic learning materials on elasticity materials to improve students' 21st-century skills. The research method is research and development by applying the Plomp model. The average validation result of the five experts is 80.0, which belongs to the high category. Therefore, research on developing STEM integrated electronic learning materials is feasible to be applied during online and offline learning.

Keywords: Electronic Learning Material, Elasticity, STEM, 21st-Century Skill

Design Interactive Multimedia Based on The Cognitive Conflict on Static Fluid Material Using Adobe Animate CC 2019

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Abstract. This research aims to determine the practicality and effectiveness of interactive multimedia to improve the understanding of 4C students' concepts and skills. The research conducted includes a type of research development research using the Plomp model. Valuable data sources are obtained at the one-to-one and small group test stages, while interactive multimedia effectiveness is obtained at the small group stage. Practical data collection instruments consist of practical instruments, concept tests on pretest-posttest, and student performance sheets. Percentage techniques are used to determine practicality, and Wilcoxon tests are used to determine effectiveness. The results of one-to-one and small group practicality tests obtained an average score of 99 and 92 with a potent category. The interactive multimedia effectiveness test results using the Wilcoxon test showed an improvement in understanding the concepts and skills of 4C students after using interactive multimedia. Thus, interactive multimedia based on cognitive conflicts are practical and effective for improving the understanding of concepts and skills of 4C students on static fluid material.

Keywords: Interactive Multimedia, Cognitive Conflict, Misconceptions, 4C Skills

E-books usage by students and educators: A study of perceptions and responses

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Abstract. This study aims to identify the perceptions and responses of teachers and students to e-books in general. Since 2020, education in Indonesia has shifted from face-to-face classroom teaching to blended learning which requires educators and students to adapt to the use of both online and offline media. Researchers gave questionnaires to educators and students. The student questionnaire aimed to determine student learning styles and responses to the use of e-books and the application of HOTS and 4C questions. The aim of the educators' questionnaire was to determine the implementation of learning using e-books. The findings established that the majority of students have an audio visual learning style and have a fairly clear understanding of e-Books. The results further determined that students cannot use e-books entirely because the available e-books were not supported by interactive multimedia. Learning became quite boring and not challenging. On the educator's side, they had not been independent in developing e-books. Most of the available e-books were not developed based on the interests and needs of students but are universal.

Keywords: e-book, learning media, physics, HOTS, Students, Educators

Intraseasonal Change of the Diurnal Cycle of Precipitation Over Sumatra from IMERG Observation

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Abstract. Madden Julian oscillation (MJO) is an intraseasonal scale circulation in the form of the formation of super cloud clusters that move along the equator and impact the area it passes through. This study investigates the intraseasonal change in the diurnal cycle of rainfall over Sumatra. Diurnal characteristics in peak and average accumulation, frequency, and intensity of rain were obtained from Integrated Multi-Satellite Retrievals of GPM (IMERG) final run product version 06 data during 2016-2019. Data were classified into active (2,3,4 and 5 phases) and inactive (1,6,7 and 8 phases) phases of MJO. Overall, the highest number of rain events over Sumatra was rain with a short duration (< 3 hours). However, the most significant change in the number of rain events (> 50%) was found during the active phase of the MJO for rain with a long duration (> 6 hours), especially around the ocean. A significant shift in the peak time of rain was also observed for long-duration rain. Areas with the peak time of rainfall in the afternoon are wider in the active phase than in the inactive phase, especially for rain with a duration > 6 hours. Intra-seasonal changes in the peak time of rainfall are more clearly observed when seasonal factors are considered.

Keywords: MJO diurnal cycle, IMERG, Sumatra

THE EFFECT OF GUIDED INQUIRY MODEL WITH A SCIENTIFIC APPROACH IN ONLINE LEARNING ON STUDENTS' COMMUNICATION AND COLLABORATION ABILITY ON HEAT AND THE KINETIC THEORY OF GASES LEARNING TOPIC IN GRADE XI AT SMAN 1 HARAU

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Abstract. This study aims to see the effect of the guided inquiry model in online learning on students' communication and collaboration skills on the topic of heat learning and the kinetic theory of gases in class XI of SMA Negeri 1 Harau. This type of research is a quasi-experimental design with a randomized only control group design. This study involved two classes, the first class as an experiment using a guided inquiry model with a scientific approach and the second class as a control class. Data collection techniques in the form of research questionnaires. Assessment is based on observable indicators of communication and collaboration skills. data analysis using qualitative descriptive analysis techniques. The results showed that there was an increase in communication and collaboration skills. experimental class 57% and control class 12%. Based on the results of the study, it can be said that: First, after the application of guided inquiry with a scientific approach in online learning, there was an increase in students' communication and collaboration skills in the experimental class. Second, there is a significant difference in the improvement of communication and collaboration skills in the experimental class after the guided inquiry model with a scientific approach to online learning compared to the control class that did not apply it.

Keywords: Guided inquiry model, Scientific approach, Communication skills, Collaboration skills

Needs Analysis as a Basis for the Development of POE-Based Physics Learning Tools in terms of Science Process Skills

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Abstract. The era of the industrial revolution 4.0 is a challenge for the world of education. Responding to these challenges requires productive human resources who have the competencies and skills that are ready to compete in the era of globalization. One of the skills that prepares students to be able to compete in the era of globalization is science process skills. One of the appropriate learning models to achieve this is to apply the POE (Prediction, Observation, Explanation) model. In order for the POE model syntax in learning to be carried out properly, the POE model syntax must be integrated in a learning tool in the form of lesson plans, LKPD and assessment instruments. The purpose of this study is to analyze the needs that exist in the field as the basis for developing learning tools based on the POE model. Analysis of needs in this study is front end analysis, analysis of students and analysis of the material. This study uses descriptive analysis method to produce information about the problems and needs in learning physics. The results obtained from this study serve as a basis and guide in developing learning tools to be more focused so that they are in accordance with learning needs. Based on the results of the analysis of this study, a POE model-based learning device was designed according to the characteristics of students, materials and learning objectives so as to improve students' science process skills.

Keywords: Needs Analysis, POE Model-based Physics Learning Tool, Science Process Skills

Development of a Physics Learning Activity for the Topic of Boyle's Law using the STEM Approach

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Abstract. The objective of this study was to develop a Physics learning activity for the topic of Boyle's Law using the STEM approach and to test the validity and feasibility of the developed activity. The research design was the developmental research using the ADDIE model. The population of this study was fifth semester bachelor of education in Physics students from one of the public universities in Malaysia. Nineteen participants were sampled using the simple random sampling technique. Two instruments were used in this study which include a self-developed questionnaire for determining the content validity of the learning activity and a feasibility questionnaire that was adapted from Structured Assessment of Feasibility (SAFE) questionnaire. Three experts evaluated the content validity of the learning activity and subsequently was analysed using Content validity index (CVI) while descriptive statistics of percentage agreement was used to analyse the feasibility of the learning activity. The result shows that the learning activity has a high content validity with a CVI value of 1. In addition, most of the data on feasibility show that the activity is feasible to be implemented in schools albeit will require extra teaching and learning time (100% agreement) and cost (100% agreement) compared to the usual teaching and learning time and cost allocated. In conclusion, the research successfully developed a tested learning activity based on the STEM approach for the topic of Boyle's Law that is quite feasible. This result implies that it can be used as a reference for teachers who are interested in conducting a STEM-based lesson with the awareness that the lesson will take more time and additional cost to be implemented.

Keywords STEM approach, integrated STEM, Boyle's Law, feasibility

The Development And Usability of Bitada Kit For Linear Motion Topics Among Physics Trainee Teachers

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Abstract. The objective of this study was to develop a BITADA kit for the topic of Linear Motion for secondary school level and to determine its usability from the perspective of Physics trainee teachers. This study uses a developmental research design by applying the ADDIE model. The population of this study was seventh and eighth semester bachelor of education in Physics students from one of the public universities in Malaysia. Forty participants were sampled using the simple random sampling technique. Two research instruments were used, namely the expert validation form and usability questionnaire adapted from the USE Questionnaire. The data were collected via Google Form and analysed descriptively using mean (M) and standard deviation (SD). The findings of this study showed that the expert agreement percentage for face validity and content validity were 96.0% and 98.3%, respectively. Meanwhile, the usability of this BITADA kit is at a high agreement level with a mean score of 4.63. The four constructs that represent usability namely usefulness, ease of use, ease to learn and satisfaction are at a good level with the mean score of 4.68 (SD=0.345), 4.49 (SD=0.327), 4.62 (SD=0.344) and 4.73 (SD=0.337) respectively. In conclusion, the research has successfully developed a validated BITADA kit that can be used as a teaching and learning kit. For implication, the BITADA kit can also increase student's motivation to learn the Linear Motion topic in an interesting environment.

Keywords: teaching and learning kit, development, usability, Linear Motion, physics trainee teachers

Development of an Interactive Learning Module for the Topic of Gas Law and Its Usability among Physics Trainee Teachers

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Abstract. This study was conducted to develop an interactive learning module for the Gas Law topic of secondary school level and to determine its usability from the perspective of Physics trainee teachers from one of the public universities in Malaysia. The research design was the developmental research using ADDIE instructional model to develop the module. A total of 30 Physics trainee teachers in semesters 6 and 8 of their studies were selected randomly as respondents of the study. The instruments used were the expert validity form and the usability questionnaire adapted from a standardized instrument. The findings showed that the developed module has a high face validity and content validity with 100% expert agreement. In addition, the findings indicated that the module was useful ($M = 3.85$, $SD = 0.25$), easy to use ($M = 3.87$, $SD = 0.21$) and the respondents were satisfied with it ($M = 3.85$, $SD = 0.31$). In general, the overall usability of the module was high ($M = 3.86$, $SD = 0.26$). Thus, this interactive learning module is suitable to be used by Physics trainee teachers to teach the Gas Law topic.

Keywords: Interactive learning module, Gas Law, development, usability

The Development and Usability of a Force and Motion Digital Game using Game-based learning (GBL) among Student Teachers in Malaysia

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Abstract. This study aimed to develop and evaluate the usability of a Force and Motion Digital Game using Game-based learning (GBL) among physics student teachers in tertiary education. The research design of this study was developmental research based on the Instructional Design-Digital Game Based Learning model (ID-DGBL model). A group of sample of 21 student teachers were chosen using cluster sampling methods for the usability test of the developed game. A questionnaire instrument was used to collect the usability data of the developed game adapted from the user testing on game. The data collected was analysed using descriptive statistics such as percentage, mean and standard deviation. Based on the findings, the percentage of expert's agreement for the developed game and questionnaire in the validity process were 100%, while the overall mean score for the usability of the developed game was 4.737 (SD=0.33) including the constructs of Game Usability (GU), Playability (PL), and Learning Content (LC). In the conclusion, the developed game was valid and reliable, as well as suitable to be used as game-based learning for the topic of Force and Motion. In the implication, the developed game was able to complement the conventional learning process by using the game-based learning.

Keywords: Game-based learning; ID-DGBL model; Force and Motion Digital Game; Usability; Physics Education

The Effectiveness of e-Simulation with Asynchronous Learning Concept to Improving Students Understanding in Physics Education Department FKIP Indonesia Open University

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Abstract. This research is motivated by the constraints of students in the Physics Education of FKIP UT who run the concept of asynchronous learning to carry out practical/demonstration activities during course tutorial activities so that it has an impact on low understanding and learning outcomes. E-simulation is here as a solution to improve understanding and strengthen theory for students during tutorial activities. This type of research is a quasi-experimental study involving a sample class of students taking mechanics courses in the 2021.1 Academic Year in Physics Education department FKIP UT. The data collection instrument in this study was an assessment sheet for student learning outcomes in the form of multiple-choice tests, and analysed using the paired sample t-test. Based on the results of the analysis, it can be concluded that the use of e-simulation can significantly improve students' understanding with a sig value. 2 tailed 0.000. E-simulation will continue to be developed by the Physics Education department of FKIP UT in order to improve the quality of learning and provide better quality distance education services.

Keywords: E-simulation, Asynchronous Learning, Students Understanding, Physics

The Development of A Game-Based Assessment Kit for Light and Optics Topics in Form 1 Science

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Abstract. This study was conducted to develop and to test the acceptability of a developed game-based assessment kit for the topic of light and optic in Form 1 Science. The study utilized developmental research design with quantitative survey approach and ADDIE model. 30 trainee teachers were randomly selected from the seventh semester of the Physics program. The instruments used in this study were validity forms and acceptability questionnaire. Statistical packages for Social Science Version 26 (SPSS) software was used to determine the value of Alpha Cronbach reliability coefficient while the acceptability level of kit was analyzed to obtain the mean score value. The validity of this developed game-based assessment kit was analyzed descriptively in percentage of expert's agreement. Results show the face validity value of the developed instrument is 92.0% while the content validity is 89.0% and this instrument had reliability coefficient value of 0.936. On the other hand, the developed game-based assessment kit has a face validity value of 89.9% and content validity value of 92.7% while overall mean score of the trainee teachers' perception of kit's acceptability is 4.66 which consists of the Design = 4.6, Content = 4.64 and Uses = 4.73. As conclusion, this developed kit has good face and content validity as well as strong acceptance value among the trainee teachers. This kit was hoped to help as aid to the teaching and learning in Form 1 Light and Optic topic.

Keywords: Game-based Assessment kit, ADDIE model, validity, reliability, acceptability

The importance of e-books in improving students' skills in physics learning in the 21st century

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Abstract. Along with the development of technology, the education system began to change from face-to-face learning to blended learning. Blended learning uses a combination of print and digital learning media. Most digital learning resources are e-books that replace the function of printed books and the role of the teacher in the classroom. The focus of research in this paper is how e-books can improve student skills in the 21st century. There has been a number of researches related to e-books and their use in high schools. In-depth literature study is needed to get a conclusion on how e-books affect students' skills, especially after studying Physics. This research provides invaluable insight into how educators were maximizing the use of e-books so as to improve student learning outcomes which in turn impact 21st century skills. These studies describe a lot of data which enables other researchers to understand how teachers use, and wish to use, e-books. The data shown were from research conducted over the last five years. The analysis of these empirical results is used as the basis for developing e-books that have effective content and features that are relevant to e-book literacy.

Keywords: e-book, students' skill, physics, 21st century, HOTS

The Development of an Interactive Learning Module in the Topic of Transistor and Its Usability Among Physics Trainee Teachers

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Abstract. The paper demonstrates the development of an interactive learning module in the topic of transistor and its usability among physics trainee teachers at one of the public universities in Malaysia. The research design was a developmental research using the ADDIE module to develop the interactive learning module. The developed module portrayed a high percentage value of expert agreement of 89.57% for face validity and 91.67% for content validity. The sample was 40 Physics trainee teachers from six-eight semesters. The instrument was a questionnaire, which was adapted from a standardized instrument to obtain the level of its usability. The usability data was analyzed descriptively using, mean and standard deviation. The findings portrayed that the usability of interactive learning module is high, with a mean value of 3.91, while the value of the standard deviation is 0.18. From the aspect of usefulness (mean = 3.90 and standard deviation = 0.1973), respondents agreed that the module could encourage active students' involvement, shorten teaching and learning time, increase students' understanding and enhance achievements in the topic of transistor. From the aspect of ease of use (mean = 3.91 and standard deviation = 0.1751) respondents agreed that the module is easy to use, user friendly, and could be used anytime and anywhere. As of satisfaction (mean = 3.93 and standard deviation = 0.1833), respondents were satisfied with the use of the module, whereby they found the module works well and is attractive. In conclusion, the interactive learning module can be used as a teaching aid for teaching the topic of transistor. In the educational implication, students can utilize the interactive learning module to explore and build knowledge simultaneously as it encourages active students' involvement in line with the constructivist learning theory.

Keywords: Interactive, Module, Usability, Transistor

DEVELOPMENT AND USABILITY OF 'GRAVIGAME' IN KEPLER'S LAW AMONG PHYSICS TRAINEE TEACHER

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Abstract. This study aimed to develop a 'Gravigame' in Kepler's law and to evaluate its usability among physics trainee teachers at one of the public universities in Malaysia. This study uses a developmental research design by applying the ADDIE model. The research sample consisted of 30 trainee physics teachers who were randomly selected from seven and eight semesters students. Two research instruments were used, namely the expert validation form and usability questionnaire adapted from the USE Questionnaire. Data from the usability questionnaire were analysed descriptively using mean and standard deviation (s.d). Data showed that the developed game has a high validity with 94% of expert agreement. The usability data analyses showed that the 'Gravigame' has an overall of mean score 3.81 (s.d = 0.282). The three constructs that represent usability namely usefulness, ease of use and satisfaction are at a good level with the mean score of 3.80 (s.d = 0.317), 3.76 (s.d = 0.254) and 3.86 (s.d = 0.276) respectively. In conclusion, the research has successfully developed a validated 'Gravigame' that can be used as a teaching aid. For implication, the 'Gravigame' game is suitable for classroom learning, making it easier for teachers to assess students and helping students understand the subtopic of Kepler's law.

Keyword: Gamification, usability, ADDIE model, Kepler's law,

The Development and Usability of a Homemade Solar Cooker as a Teaching Aid for Learning Thermodynamics

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Abstract. This study aims to develop a homemade solar cooker to be used in teaching and learning Thermodynamics. The research was based on the Design and Development Research (DDR) approach using the ADDIE model as an instructional design framework. The survey method was used to gather information about the solar cooker usability as a teaching aid. The sampling technique used in this study is a simple random sampling that involved 30 respondents consisting of fifth-semester physics trainee teachers who had taken the Thermodynamics course. The research instrument consisted of validation and survey forms that have been validated by experts ($n = 2$). The data obtained through survey questionnaires were descriptively analyzed by the mean values and standard deviations (sd). Findings showed that the usability of solar cooker as a teaching aid were high i.e. the usability perception (mean = 4.57, sd = 0.349), usefulness aspect (mean = 4.58, sd = 0.373) and user satisfaction (mean = 4.47, sd = 0.459). The study shows that the solar cooker can be used by students to learn Thermodynamics. It is hoped that the finding of this study will ignite future studies in the development of homemade products by the teacher that relates the concepts and theories of Physics with real life as well as the environment.

Keywords: Solar cooker, Teaching Aids, Thermodynamics, Trainee Teacher, Usability

DEVELOPMENT AND USABILITY OF JUQUANJI GAME IN QUANTUM THEORY OF LIGHT AMONG PHYSICS TRAINEE TEACHERS

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Abstract. This study aimed to develop a teaching aid namely 'JUQUANJI' and evaluate its usability among physics trainee teachers at Sultan Idris Education University. 'JUQUANJI' is adapted from the JUMANJI board game and developed by using Genialy website tool. This study uses a development research design by applying the ADDIE model, which has five phases: analysis, design, development, implementation and evaluation. The research samples consisted of 32 trainee physics teachers from semesters seven and eight selected using a simple random sampling technique. Two research instruments were used, namely the expert validation form and usability questionnaires adapted from the USE Questionnaire. Data from the usability questionnaire were analysed descriptively using Statistical Package for Social Science (SPSS) version 26.0 to obtain the mean and standard deviation (s.d). The data analyses from two experts showed that the developed game had a very satisfactory validity with 99.48% of agreement. The usability data analyses showed that the 'JUQUANJI' game was at a good level with a mean score of 3.79 (s.d = 0.353). The three constructs that represent usability namely usefulness, ease of use, ease of learning and satisfaction are at a good level with the mean score of 3.71 (s.d = 0.385), 3.73 (s.d = 0.391), 3.83 (s.d = 0.333) and 3.89 (s.d = 0.304) respectively. In conclusion, 'JUQUANJI' game has achieved the research objectives which is proven through the findings from the validity of experts and usability. This game suitable to help teachers to assess students while the student can make a revision related to the subtopic of Quantum Theory of Light.
Keywords: Gamification, ADDIE Model, quantum theory of light, usability

The Development of a Low-cost Experimental Kit on Image Formation by a Lens and Its Usability Perception among Pre-service Teachers

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Abstract. This study aimed to develop a low-cost experimental kit on image formation by a lens and determine its usability perception among pre-service teachers. A standard experiment kit on image formation by a lens in the secondary school syllabus uses an optical bench and a ray box set. The kit might not be available in school due to its cost. Furthermore, the experiment must be handled in a lab with teacher supervision because of electrical safety using the ray box connected to a power supply. Therefore, a low-cost with simple design experimental kit is developed with the same learning outcome as the standard kit. The research design is the developmental research using the ADDIE model. The intended kit was successfully developed with an acceptable Content Validity Index of 0.92 from three experts. The usability perception was surveyed using an adapted questionnaire distributed to 26 respondents from an accessible population of pre-service teachers. All constructs of the usability perception were scored more than 4.6 over a scale of 5, indicating the kit was usable. This study implies that the low-cost kit could be implemented in schools with limited instruments in image formation by a lens while achieving the same learning outcome as the standard kit.

Keywords: Low-cost, Image Formation, Teachers

The Development and Usability of Optics Kit as a Teaching Aid among Physics Trainee Teachers

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Abstract. This study was conducted to develop a teaching aid known as the Optics Kit. This Optics Kit consists of tools and learning modules that were designed according to form four physics DSKP syllabus. The study utilized the ADDIE Model as the instructional design which embraced the quantitative survey method. The developed Optics Kit has obtained validity from the experts while its usability were conducted among physics trainee teachers which consists of 30 trainee teacher from the Bachelor of Education (Physics) programme that were selected via cluster sampling method. The instruments used in this study was the validity questionnaire and usability test which were adapted from previous research. Data analysis was conducted using SPSS software. Results obtained from this study found that the validity value of Optics Kit and the usability test based on the percentage of expert consent are 100% and 97.9%, while the mean score value for the usability of this Optics Kit is 4.98. These findings show that the Optics Kit has high validity and strong agreement on usability of the Optics Kit as a teaching aid. In conclusion, this Optics Kit was successfully developed to be used as a teaching aid for the topic of Light and Optics.

Keywords : Optics, Teaching and learning, teaching aid, ADDIE Model

Museum as An Active Discovery, Learning and Outreach Centre for STEM Education

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Abstract. Museums of all kinds have enormous potentials to re-invent beyond their traditional roles as archives of heritage and civilisation, to become the knowledge centres for teaching, learning and discovery through education and outreach activities. It may even serve as the authentication expert services for private collectors. In realising these opportunities, it is important to invest on training museum officers with R&D skills, enrich the specimen inventories, documentations with accurate historical evidences and scientific verifications. Despite having extensive collections, many museums are lacking in strong R&D support for material characterisation and/or restoration of their specimens. This initiative attempts to encourage researchers from multidisciplinary fields at the universities to share their knowledge, skills and advanced instrumentation to explore the treasure troves of local museums for education, research and to revive appreciation for national and regional heritage. In this presentation, we share some of the ongoing efforts by a group researchers from the STEM and Arts & Humanities faculties of Universiti Malaya in using artefacts collection at the university's Museum of Asian Art (MoAA), in particular the ancient ceramics for material science, engineering and digital technology education, in retrospective. Through MoAA, we are empowering other university museums to take up active roles in providing more opportunities for local and foreign students to do their industrial training internship, short-term mobility programs and STEM outreach programs by fostering linkages with diverse research centres within the institution. Through digital technologies, there are also potentials for virtual learning experiences. We believe the redefinition of museum as an active classroom/laboratory allows the institution to offer holistic learning experience in STEM, Art and Humanities subjects. (This work is supported by the Universiti Malaya Impact Oriented Interdisciplinary Research Grant, "Technology Content Of Museum Ceramics For Dating And Recreation" (No. IIRG008C-19SAH)).

Electromechanical Properties of Piezoelectric and Ferroelectric Polymers

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Abstract. Piezoelectric polymers are widely used in sensor and actuator applications. Compared to ceramic materials, they have the advantage of mechanical flexibility and an acoustic impedance similar to those of water or air. Piezoelectric properties of polymeric substances arise from either the poling-induced orientation of molecular dipoles (Class 1) or the uniaxial orientation of chiral chain molecules (class 2). The class 1 polymers include ferroelectric polymers, polar polymers with frozen-in dipole orientation and the composites of polymers with ferroelectric ceramics. The class 2 polymers consist of drawn optically active polymers and exhibit face-shear piezoelectricity appearing in proportion to the orientation coefficient of chain axes. The spontaneous polarization of ferroelectric liquid crystalline polymers is attributable to this type of piezoelectricity coupled with the spontaneous strain. The electrical, electromechanical and mechanical properties of piezoelectric polymers can be investigated by analysing piezoelectric resonances in their dielectric spectrum. Apart from its ability to reveal the high frequency behaviour of piezoelectric polymer films, this technique is appealing from a practical point of view because several important parameters can be measured with a single scan that only requires standard dielectric spectroscopy equipment commonly found in many laboratories. This talk discusses the theoretical basis of piezoelectric resonance, as well as the practical features and contemporary applications in the field of piezoelectric polymers.

Sodium ion batteries based on Acid-Etched Prussian Blue as positive electrode materials

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Abstract. The ever-growing demands of portable devices and even the development of electric vehicles have triggered a new revolution of energy storage system. Lithium-ion batteries (LIBs) as mostly used energy storage device are facing an enormous challenge due to the scarcity of resources. Sodium-ion batteries (SIBs) can be the alternative candidate for the large-scale energy storage system. Thus, the development of the practical SIBs is extremely urgent. Prussian blue and its analogues (all are abbreviated as PB) have been investigated as the potential cathode material for SIBs due to their easy synthesizing process, low cost and non-toxicity. However, PB suffers the capacity fading at a high C rate and long cycles of charge/discharge. In this work, we synthesized PB via a facial method and etched by acid to obtain the cage-like structure PB (PB-C). The as-synthesized PB-C exhibited an excellent electrochemical performance. PB-C deliver the specific capacity of 112 mAh g⁻¹ at 0.2 C and 97 mAh g⁻¹ at 10 C. During 1000 charge-discharge cycling, there is no obvious fading with a capacity retention of more than 80%. The high electrochemical performance might be due to the pseudocapacitance effect of the nano-size PB-C (with superior specific surface area) which is confirmed via cyclic voltammetry (CV) at different scan rates. This good performance at high C rate and long cycles show that PB is one of the best candidate as practical SIBs cathode.

Keywords: Sodium ion batteries; cathode; Prussian blue; Porous structure; Pseudocapacitance

PC Sound Card: Transformation to High Technology Physics Experiments

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Abstract. Experiments are not only an essential component in expanding our knowledge but also play as a significant role in learning and teaching, especially in physics. Normally, some physics experiments are performed using specialize and expensive equipments. Due to the high cost, it is a major challenge financially to acquire, maintain and upgrade the equipments. These relatively expensive and specialize equipments make it difficult for many schools to be involved in laboratory work. Hence, students are deprived from performing some basics experiments, which are important in explaining the fundamental principal of physics. In order to create more conducive and engaging environment, we investigate the possibility of utilizing the PC sound card as sensors to determine the speed of sound directly. A special emphasis is given on easy to assemble experiments that can fit within the budget of any schools. Two methods are chosen, time of flight and resonance method, to exhibit the usability of PC Sound Card in performing the experiments. The result are compared with the experiment using Phyphox applications. The speed of sound in air is found to be $340.6 \pm 6.3 \text{ ms}^{-1}$ as compared to the value measured using the echo method of Phyphox applications which is $341.2 \pm 1.2 \text{ ms}^{-1}$. Three selected experts in physics education have been involved to determine the validity of the experimental module while 15 trainee teachers from UPSI's Physics Education Program have been engaged to study the usability of the experimental module using random cluster sampling techniques. It has been found that the agreement among the experts which is 100% for face validity and 98.33% for content validity. The finding from the usability study shows that all items obtained a high mean score value with a range of 3.55-3.90. Therefore, it is concluded that the technique and the experiment has a high potential to be used as a hand-on and an alternative method to determine directly the speed of sound in school.

Keywords: PC Soundcard, Soundcard Scope software, Computer Technology and Phyphox

Development And Perception of Usability of Optical Spectrometer Kit as A Teaching Aids for Blackbody Radiation Subtopic Among Trainee Teachers in Universiti Pendidikan Sultan Idris (UPSI)

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Abstract. The study is aimed to develop Optical Spectrometer Kit as a teaching aid for subtopic Black Body Radiation using the developed optical spectrometer kit. The development of the Optical Spectrometer Kit is based on the ADDIE instructional design model which follows five steps namely Analysis, Design, Development, Implementation and Evaluation. This kit is purposely designed for pre-university students and also suitable for off campus learning. In the development process, validity from experts is obtained. The validation process through three experts using a validity instrument. A total of 30 trainee teachers in Sultan Idris Education University (UPSI) were chosen using a simple random sampling method as a studied subject. Research instruments, which is a questionnaire on perception of usability of Optical Spectrometer Kit that have already undergone pilot tests and had reached the reliability (Overall of Cronbach's Alpha Value, $\alpha = 0.949$) were distributed to the respondents to know about their perception based on this usability of the kit. Data analysis in a way descriptive was carried to find the frequency, mean and standard deviation. The findings show the overall validation percentage of the development of Optical Spectrometer Kit is (face validity = 90%; content validity = 85%). While, the respondent's perception on the development of Optical Spectrometer Optic as a teaching aid for the usefulness aspect (min = 3.76; standard deviation = 0.325), ease of use aspect (min = 3.73; standard deviation = 0.313), satisfaction aspect (min = 3.75; standard deviation = 0.331). Overall, the mean value is 3.74 and standard deviation value is 0.323. As a conclusion, the development of Optical Spectrometer Optic has a high validity level and has a good perception among the trainee teachers.

Keywords: teaching aids, spectrometer, Black Body Radiation, usability

The Development Of An Optic Learning Module Using Genially And Its Usability From The Perspective Of Physics Undergraduates

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Abstract. The use of teaching aids is one of the contributors to the achievement of good teaching objectives for a teacher. This study was conducted to develop an Optics Learning Module using Genially and to determine its usability among Physics undergraduates from one of the public universities in Malaysia. The research design used was the developmental research design using ADDIE model. This study used the simple random technique to select 40 respondents from seventh semester Physics undergraduates. In addition, two experts were selected to validate the module. The usability instrument used was a self-developed questionnaire that was divided into three parts, namely the task, the content of the module and the perception of user for the Genially based module . Data were analysed descriptively using percentage of agreement, mean and standard deviation. The result showed that the module has high validity with ~97% expert agreement. The mean score for the perception of this module is 3.2988. In conclusion, the research is successfully developed a high usability module and can be used as a resource for teachers in teaching and learning.

Keywords: Development, usability, learning modules, Optics, Genially, undergraduates

Smartphone-Based Learning Module (Speed Of Sound) In Physics Education: Development, Validity and Perception To Usability Process

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Abstract. Teaching and learning activities are the most important factor in the world of education to ensure effective learning occurs. This research aims to develop a learning module to apply the concept of resonance to measure the speed of sound and study its perception to be used as teaching aid for Sound waves topic. The development of the Smartphone-based learning module is based on the ADDIE instructional design model which follows five steps namely Analysis, Design, Development, Implementation and Evaluation. Pre-university students will benefit from the module as this module can also be used personally as STEM activity. In the development process, face and content validity from experts is obtained through a validity instrument. A total of 30 pre-service teachers in Sultan Idris Education University (UPSI) were chosen using a purposive sampling method as a studied subject. Research instruments, which is a questionnaire on perception of usability of Smartphone-based learning module that have already undergone pilot tests and had reached the reliability (Overall of Cronbach's Alpha Value, $\alpha = 0.95$) were distributed to the respondents to know about their perception based on this development of the module. Descriptive data analysis was carried out to find the frequency, mean and standard deviation. The findings show the overall face and content validation percentage of the development of Smartphone-based learning module are 95% and 93% respectively. While, the respondent's perception on the development of Smartphone-based learning module as a teaching aid for the usefulness (min = 3.88; standard deviation = 0.27), ease of use (min = 3.80; standard deviation = 0.34), satisfaction (min = 3.90; standard deviation = 0.27). As a conclusion, the development of Smartphone-based learning module has a high validity level and has a good perception among the pre-service teachers.

Keywords: Learning module, smartphone, Kundt's tube, standing wave, resonance, ADDIE model

The Development of 'Monoelectric Kit' for the Topic on Series and Parallel Circuits for Secondary School Science and Its' Usability among Physics Trainee Teachers

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Abstract. This research aim is to develop a 'Monoelectric Kit', a teaching aid for the topic on Series and Parallel Circuits at the secondary school level. The research design is the developmental research using the ADDIE instructional model. The sample were 27 Physics trainee teachers from seventh semester of one of the public universities in Malaysia who were sampled using the random sampling technique. The usability instrument used was a questionnaire that was adapted from a standardised questionnaire with a four-point Likert scale rating. It has four dimensions, namely usefulness, ease of use, ease learning, and satisfaction. The validity of the kit was evaluated by three experts in the field. Data were analysed using percentage agreement, mean, and standard deviation. The validity data show that the kit has a high validity with a percentage agreement of 97.63%. The overall mean for usability was (M=3.58, SD=0.39) with the mean and standard deviation (M=3.58, SD=0.39) for usefulness, (M=3.59, SD=0.39) for ease of use, (M=3.62, SD=0.37) for ease of learning and (M=3.55, SD=0.41) for satisfaction. In conclusion, the research successfully developed a validated 'Monoelectric Kit' that can be used as a teaching aid and has a potential to improve student understanding of the concept of Series and Parallel Circuits.

Keywords: Learning kit, series circuit and parallel circuit, usability, science

The Development of 'Do-It-Yourself' Water Rocket Launcher for Science Trainee Teachers

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Abstract. This study aimed to develop a water rocket launcher kit with a Do-It-Yourself (DIY) concept for science trainee teachers. The research design is the developmental research using the ADDIE model. The need analysis found that many trainee teachers had never handled water rocket activities. The intended kit was successfully developed with an acceptable Content Validity Index of 0.92 from three experts. The water rocket kit consisted of a quickly assembled launcher of segmented PVC pipes and several essential components with an instruction manual. Qualitative feedback was obtained from a group of science trainee teachers in an accessible population of a Malaysian university. This study implies that water rocket activities can be performed by trainee teachers with simple kits that can be built on their own, thereby achieving the specific learning objectives in the planned classroom. In addition, this study can also provide early exposure to trainee teachers in the construction and operation of water rocket launchers in schools.

Keywords: water rocket, DIY, trainee teacher

The Development of a Virtual Reality Video In The Topic of Magnetism and Its Usability From The Perspective of Undergraduate Science Education Students

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Abstract. This study aims to develop a virtual reality (VR) video for teaching and learning on the topic of magnetism and to determine its usability from the perspective of undergraduate science education students. This research implements a developmental research design by utilizing the ADDIE model. A total of 72 undergraduate science education students in their sixth to the eighth semester of study from one of the public universities in Malaysia were selected as respondents by using the convenient sampling technique. Research instruments used were the expert validity form and the usability questionnaire adapted from a standardized instrument. Data were analyzed descriptively using percentage of agreement, mean and standard deviation. Two experts were involved in validating the VR video. The research found that the developed VR video has a high face and content validity with 90% and 85% expert agreement, respectively. The usability of the VR video is also high with a mean score of 4.70 (SD = 0.36). In conclusion, the research successfully developed a validated VR video that can be used as a teaching and learning aid. The VR video has the potential to improve student engagement with an immersive learning experience that will enhance students' motivation to learn and explore their learning in a different view that accelerates their talent in learning.

Keywords: Virtual reality video, usability, magnetism, learning

Development of A Free Fall Motion Experiment Based on Smart Phone Using Phyphox Application

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Abstract. The objective of this study is to develop a free fall motion experiment based on smart phone using Phyphox application and to determine its usability and perception among pre-service teacher. The research development is based on the ADDIE model. Thirty participants were sampled using the simple random sampling technique. A questionnaire instrument was used to collect the usability, easy of use and satisfaction data of the experimental kit. Data were analysed descriptively using percentage of agreement, mean and standard deviation. Both instrument and kit are measured by three experts and gain overall validity is 95% which is interpreted as very good. A pilot test was carried out among fifteen pre-service teachers where the reliability of the usability questionnaire is $\alpha = .92$ (excellent). In result, the average mean for usability is 3.91, ease to use is 3.84 and satisfaction is 3.91 out of four, which implies the average percentage of agreement is 87.25%. In conclusion, the development of a free fall motion experiment using Phyphox application was valid and reliable, as well as high agreement among pre-service teachers. Implications of the study, the experiment kit developed is suitable for use in learning to help students understand the subtopics of free fall motion.

Keywords: Free fall motion experiment, Phyphox application, ADDIE, smartphone, pre-service teacher

Developing an Energy Band Gap Model and its Usability from the perspective of Physics Undergraduate Students

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Abstract. This research aimed to develop an energy band gap model and determine its usability from the perspective of physics undergraduates from one of the public universities in Malaysia. This research design used is developmental research using the ADDIE model. Twenty eight respondents were selected using the simple random sampling technique from seventh semester physics students. The instruments used were validity form and questionnaires adapted from the Technology Acceptance Model (TAM). The validity data were analysed using the content validity index while the usability data were analysed descriptively using mean and standard deviation. The results showed that the energy gap model has a high value of CVI (1.00). In addition, the usability by mean and standard deviation are 3.75 and 0.45 respectively. In conclusion, the research has been successfully developed a model, and proven that it is valid and can be used in teaching and learning process.

Keywords: Energy band gap model, usability, science

Competency Analysis Model to Develop Dimensions Variation of Knowledge and High Order of Thinking Skill (Hots) In High School Physics Learning Content

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Abstract. The main goal to be achieved in learning physics in high school is mind set changing that occurs in students, in line with the mastery of physics knowledge they have. For this reason, it needs learning content that consist of various dimensions of knowledge and can train and improve students' cognitive processes. Preliminary research has been carried out in several high schools in districts and cities in West Sumatra, Riau and Jambi, to determine the characteristics of the applied physics learning content. The results show that the learning content applied: a) still contains very little procedural and metacognitive knowledge, b) the level of cognitive processes at the HOTS level has not been implemented properly, and c) there are still many teachers who do not understand the process of competency analysis in developing content and conducive learning process. This article aims to describe the competency analysis process in developing a valid conceptual model of knowledge variation and cognitive process levels for high school physics students

Keywords: Mindset, competency analysis, knowledge dimensions, level of cognitive process HOTS, high school physics learning, Force and Motion of Objects

Analysis of Physical and Chemical Properties of Iron Sand in Ulakan Tapakis Padang Pariaman

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Abstract. In recent years, the demand for crude iron sand from the domestic steel industry has increased considerably. An area containing the Padang Pariaman Regency of the Ulakan Tapakis subsection of Tiram Beach, offshore iron sand. According to previous research [3], the iron sand found around Tiram Beach extended to Tiku Agam Regency. In addition to checking the distribution of a large quantity of iron sand, it is also necessary to test its quality to understand its prospects as a raw material in the industry. Iron sand samples were collected at 45 points around the research site. The sample is a combination of drill and test wells. In addition, quality testing activities are carried out in the laboratory to determine the iron content. It can be concluded that the Fe content of iron sand has a linear relationship with depth. The iron sand expanse is located about 30 meters from the sea. The average mass of iron (Fe) measured by atomic absorption spectrophotometry (AAS) is 2.4%.

Keywords: Fe, Susceptibility, AAS, Ion Sand

Geological Modeling to Calculate the Resource Estimation of Ion Sand in Ulakan Tapakis Padang Pariaman

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Abstract. The potential for iron sand in the Ulakan Tapakis of Padang Pariaman regency is very large and further studies are needed to support the improvement of the steel and cement industry in West Sumatra. In mine planning, geological investigation and modeling have a big role. The accuracy of the sediment model and the amount of resources are the basic in making future decisions. In this study, modeling was carried out based on lithological data of the iron sand area in Ulakan Tapakis Padang Pariaman. A total of 30 points are scattered with a distance between points approximately 20 meters. The lithology interpretation is arranged according to the geostatistical data format. There were 2 stages in this modeling. First, the average thickness value was processed will produce 2D lateral spread of iron sand, then the lithological data was compiled and topographically corrected to obtained 3D model. Both of these processes were used the ordinary kriging method which produces a representative model. The results obtained are iron sand spread on the surface to a thickness of 1.5 meters with total resources of 78,000 m³ for a research area of 52,000 m².

Keywords: Geology, Modeling, Kriging, Ion Sand, Resource

Low-cost commercial graphite-rich pencils for passive radiation dosimetry

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Abstract. The radiation damage in graphite invokes intrinsic and extrinsic stacking faults corresponding to interstitial and vacancy clusters formation as the principal cause of physical property changes. Present research has made use of different thicknesses 2B grade of polymer pencil lead graphite (PPLG) (approximately 95 wt % graphite contents), addressing on the variation in lattice structure and defect resulting from the ionising radiation, including photon, electron and neutron, doses ranging from 0.5 up to 200 Gy. Structural interaction alterations resulting from the radiation doses being observed via Thermoluminescence (TL), Raman, Photoluminescence (PL) spectroscopy, and X-ray diffraction (XRD), providing information on physical parameters relating to the defects participating in the luminescence process. The dose-dependent defects produced in graphitic structures were characterized based on the Raman ID/IG intensity ratio, with observation of the Wigner effect. When all results are considered, 0.3 mm PPLG is forecasted to be a good material for dosimetry. The outcome of these lines of research is intended to inform the development of versatile graphite radiation dosimeters as a low-cost effective system for radiation detection, not least offering tissue equivalence and high spatial resolution that is suited to passive radiation sensing for a range of ionizing radiation applications.

Low Energy Plasma Focus Ion Beam Emission

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Abstract. Increasing demand of energy to support the rapid growth of human race has motivated researchers to look for alternatives in the search of solution for limitless energy source. One such alternative is based on plasma technology making use of pinch effect to produce hot and dense fusion plasma. This in turns has led to the development of Plasma Focus (PF) device. Plasma focus device making use of high electric current (kA) to heat and compress the gas of several mbar in the chamber, forming a plasma with extreme condition necessary for fusion reaction to occur. The plasma is of very high temperature (10 – 30 million degree Celsius) and high density ($\sim 10^{19}$ particles/cm³) but short-lived in the order of tens to hundreds nanoseconds. This transient nature of the pinched plasma is also a rich source of various radiation including x-ray, neutron, electron and ion beam thus making the plasma focus a versatile device as pulsed radiation source for various application in material science, radiation medicine, lithography, cancer research and fusion programme. Many research has been devoted to the studies of plasma focus as pulsed ion beam source for their potential application in beam-target fusion, ion implantation and surface modification. Nevertheless, active research is still ongoing to understand the mechanism and optimization of the ion beam emission to extend the versatility of the plasma focus device either in energy or other prospect application. In the present work, experimental studies were carried out to characterize the ion beam emission from a low energy Mather type plasma focus device. Deuterium was used as the working gas and ion beam emission were examined by varying operating pressures. Ion beam measurement was carried out with biased ion collector and solid-state nuclear track detector (CR-39). Correlation of ion beam emission with operating pressure was analysed and discussed. At input voltage of 14.5 kV, the ion beam energy of few times the applied voltage was obtained indicating the presence of high accelerating field upon the plasma pinch.

Tool Modeling System of Atwood Machine Experiment with Free Fall Remote Control for Tracker Video Analysis

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Abstract. An interesting physical phenomenon to observe is the dynamics of motion. A physics tool to observe the dynamics of motion phenomena can be used Atwood Machine. From the result of observation, it was known that the Atwood Machine experiment was still done manually by using the ruler and stopwatch to determine the speed and acceleration of a falling object. Besides that, the Atwood machine experiment manually had a big error and was unable to visualize the results of the experiment. A solution to solve this problem is to use a tracker video analysis and tool modeling. The analysis result on the tracker can display the position graph, the speed graph, the acceleration graph, and the rope tension graph. Based on the data analysis, It can be stated third research results. First, the average accuracy of the modeling tool of the Atwood machine experimental is 0.99, while its precision is 0.99. This means both the accuracy and precision of the modeling tool of the Atwood machine can be classified into the high category. Second, changes in the height of objects cause changes in velocity while the acceleration and tension of the rope are constant. Third, changes in mass of object cause changes in velocity, acceleration, and rope tension. Thus, the modeling tool of Atwood machine experiment with falling object regulator can be used for experimental activities in the Physics laboratory.

Keywords : Tool Modeling, Adwood Machine, Free Fall, Remote Control, Video Analysis

First-principles Density Functional Theory Study of Novel Materials for Energy Storage and Conversion

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Abstract. To design an efficient energy storage or conversion devices, theoretical input is very important to provide the fundamental understanding and guideline for experimental scientists, to fabricate the most efficient device. This desire can be made possible if computational scientist employed appropriate theoretical tools to design and predict the properties of an energy material. This presentation highlights some of our recent efforts in this direction. In this present, I will focus on two important classes of materials: perovskites and 2D materials. Halide perovskites have emerged as the most potential candidate for the next-generation solar cells. We have conducted a comprehensive first-principles density functional theory (DFT) simulations on the photo-energy conversion efficiency of the $\text{CH}_3\text{NH}_3\text{PbI}_3/\text{C}_{60}$ heterojunctions. For the 2D materials, I will introduce our recent works on novel 2D materials for metal-ion batteries.

Keywords: density functional theory; energy materials; perovskites; 2D materials

Perturbations For Coaching Implications – A Preliminary Study on Swinging Arm Coordination During Tennis Forehand STROKE

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Abstract. The purpose of this study was to describe swinging limb joint co-ordination while executing the tennis forehand stroke and to establish the effects of a perturbation on joint co-ordination between players of different skills levels to determine if the intended perturbations are required during training. A total 25 forehand stroke performed by 1 *novice* and 1 *skilled tennis players* respectively were captured using a 12-camera high-speed optical camera system at 250hz. Swinging limb joint co-ordination differs between players possibly due to differences in swinging kinematics. When subjected to perturbations, it took a longer time for the novice player to return to normal *swinging* patterns. Even with perturbations, the skilled player adapted their swinging limb co-ordination to ensure optimal performance outcomes. This strategy is key for coaching implications where including perturbations during training will provide players with the know how to re-adjust their swinging patterns most quickly when performing the next forehand stroke.

Keywords: Tennis, forehand, perturbations, variability, movement patterns.

Synthesis of 1D Nanomaterials for Renewable Energy Applications

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Abstract. One-dimensional (1D) based nanowire electrode has been recently attracting extensive interest in energy storage and conversion applications owing to its unique physical properties of extremely large surface areas and good electrochemical capability. In our group, we grow various types of 1D nanowires from single-crystal nickel silicide and silicon nanowires to Ni₂Si/SiC core-shell nanowires, metal-oxide (In₂O₃) nanowires and composite nanowires, and manganese silicide (MnSi) and higher manganese silicide (MnSi_{1.7}) nanowires. High metallic nanowires such as Ni₂Si, MnSi, and their heterostructures possess excellent physical properties such as thin, straight, long, and single-crystalline structure which resulting to high aspect ratio above 1, 000 and extremely large surface area in an order of 10¹² NWs/cm². The fabricated Ni₃Si₂ NWs/activated carbon-based asymmetric supercapacitor demonstrated a maximum specific capacity of 578.3 C/g and energy density of 62.24 Wh/kg at 387.5 W/kg, and good cyclic stability with 76 % of capacity retention after 3, 000 cycles. The energy and power densities bridging the gap between the batteries and supercapacitors. The semiconducting nanowires of Si, In₂O₃, and composites, have showed a significant enhancement in their current density at low potential voltage (below 3 V) as compared to their single structures. The In₂O₃ composited with WO₃ and W₂N crystal structures have increased the active surface areas in water-splitting reactions by facilitating the visible light absorption efficient and improving the charge separation between the electrodes and aqueous solutions. The hybrid 1D structure of Ni₂Si/SiC core-shell nanowires improved electrical conductivity (9.10 Å⁻¹—10³ i⁻¹—1cm⁻¹) and electrochemical stability (above 80 % capacity retention) compared to intrinsic Si and SiC nanowires. These enhanced properties of the NiSi/SiC core-shell nanowires could potentially use for nanowires-based devices in harsh environment applications such as field effect transistors, field emitters, space sensors, electrochemical devices, and supercapacitors.

Microcannular Electrode/Electrolyte Interface for Energy Storage Devices

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Abstract. Nowadays, the demand for sustainable and reliable energy increases. Therefore it needs to be emphasized on energy storage devices. It is a crucial device that providing an uninterrupted and stable energy supply. The interfaces between electrode and electrolyte are the keystone for a better performance of energy storage devices. Hence, the exploration on this matter is high-priority. A great initiative is by introducing a microcannular structure at the electrode and electrolyte interfaces. Fundamentally, a microcannular structure can be described as a structure in a micro, μ size that has a porous and hollow (tube) nature. The microcannular structures providing a channel for the transportation of charge carriers from the electrolyte to the electrode. The specialty of these charge carriers (i.e., cations) that could detach the functional group of the microcannular structure helps for a better charge carriers' movement between the interfaces. In addition, this unique channel also can reduce the gap at the interfaces of electrodes and electrolytes. Thus, it reduces the charge transfer resistance. Hence, it improves the energy density and power density of the energy storage device during both the charging and discharging processes.

Keyword: Microcannular, Energy storage, Electrode-electrolyte interfaces, Hollow

The Development E-Learning Assisted by Flashcard to Improve Students' Scientific Literacy in Senior High School in Gas Kinetic Theory Materials

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Abstract. This study aims to development e-learning assisted by flashcard to improve students' scientific literacy in senior high school in gas kinetic theory materials. The method used in this study is Research and Development (R&D) with the Dick & Carey model approach because it is an effective approach model in independent learning. Each procedure contained in the Dick & Carey model develops an organized learning unit, and can help students in the learning process which consists of ten stages. Respondents in this study consisted of expert validator respondents, namely: material experts, media experts, and learning experts, as well as physics teachers and students of class XI SMA. The average validation results by media experts are 89.58%, material experts are 90.65%, learning experts are 94.15% and by class XI physics teachers are 96.00%. The average value of the overall validation test by experts is 92.6% with the interpretation of "very good". This e-learning was tested on online class XI students. Based on these results, it shows that the use of e-learning assisted by flashcard on gas kinetic theory material is feasible to be used as a physics learning medium, and can increase the scientific literacy ability of high school students with an N-Gain of 0.44 on a medium increase interpretation.

Keywords: e-learning, flashcard, scientific literacy.

GW171817 Binary Neutron Star Merger Event: Equation of State of Nuclear Matter at Supranuclear density

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Abstract. A set of equations of state (EoS) from various non-relativistic interactions are used to investigate the recent observation of gravitational waves from the binary neutron star merger GW170817 event. For these sets of interactions, the neutron star tidal deformability (related to the second Love number), the mass-radius trajectory, and the moment of inertia (I) will be explained. The I -Love relation will be discussed along with the correlations among the tidal deformability of the canonical neutron star, its radius, and the derivatives of the nuclear symmetry energy at the saturation density. Most of the obtained results are consistent and located within the constraints of the tidal deformability extracted from the GW170817 binary neutron stars merger events [1-3].

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Interferometer Technique and Radio Quiet Zone Characteristics for Radio Astronomy in Tropical Countries

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Abstract. Linking more than one radio telescopes is an effective technique in radio astronomy research especially in terms of promoting research collaborations between countries. This technique, however, is affected by humidity factor as well as by the increase in radio environment pollution by man-made interferences. These two issues are discussed in this talk, especially in regards to the case of Malaysia as well as in tropical countries in general. The ultimate aim of setting up a radio quiet zone in Malaysia is also discussed through the results and analysis of radio interference surveys done throughout Peninsular Malaysia.

Need analysis of developing a generative learning model based on cognitive conflict in Computational Physics during the Covid 19 pandemic

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Abstract. The discovery learning model with the lecture method interspersed with the question and answer method with the multiplier question technique and accompanied by project assignments based on case studies that previously could help students understand Computational Physics material, but in the last 5 years this method is no longer effectively used to build student competence in Computational Physics (Akmam 2018). The problem may be solved by developing a new learning model, namely a generative learning model based on cognitive conflict. For this reason, a need analysis has been carried out which aims to find out what factors and aspects are needed to develop a generative learning model based on cognitive conflict in Computational Physics during the Covid 19 pandemic. Descriptive research has surveyed 130 students who have taken Physics courses. The survey was conducted using a questionnaire with a Likert Scale through the media google form. The results showed that students need a challenge given to each new topic to arouse curiosity (52.27% agree and 25.00% strongly agree) and need an assimilation process to build knowledge about Computational Physics (60.61% agree and 23.48% strongly agree). Students feel the need to think creatively in order to build knowledge of solving computational problems is a must (52.27% agree and 39.39% strongly agree). Changes in strategies and methods as well as learning steps by lecturers are a must (33.33% agree, 29.55% strongly agree).

Keyword: Need analysis, generative learning, cognitive conflict, Computational Physics

ANALYSIS MAGNETIC SUSEPTIBILITY OF IRON SAND PASIA JAMBAK BEACH, PASIA NAN TIGO, PADANG BASED ON DEPTH

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Abstract. West Sumatra has the potential of abundant natural resources in the form of iron sand, one of which is located in the Pasia Jambak Beach area, Pasia Nan Tigo, Padang. Minerals such as iron sands have *magnetite* (Fe_3O_4), *hematite* ($\alpha-Fe_2O_3$), and *maghemite* ($\gamma-Fe_2O_3$) which can be used as a mineral of high economic value. Before being used, it is necessary to know the minerals contained in iron sand, one of which is magnetic minerals. This study aims to investigate the magnetic mineral content in the iron sand of Pasia Jambak Beach, Pasia Nan Tigo, Padang based on its magnetic susceptibility. Magnetic susceptibility measurements were carried out using a *Bartington Magnetic Susceptibility Meter* with a *MS2B* sensor *dual frequency*, where the magnetic susceptibility value was dependent on *low field* (470 Hz) and *high field* (4700 Hz). The results showed that the magnetic susceptibility value of the iron sand of Pasia Jambak Beach, Pasia Nan Tigo, Padang varied based on the depth from $291,1 \times 10^{-8} m^3/kg$ to $12.445,5 \times 10^{-8} m^3/kg$ with an average value of $2.016, 35 \times 10^{-8} m^3/kg$. The susceptibility values obtained at each depth have changes or variations in the susceptibility values that are irregular or do not have a certain pattern. Type of magnetic minerals contained namely *ilmenite* ($FeTiO_3$) and *hematite* ($\alpha-Fe_2O_3$) which is antiferromagnetic.

Keywords: *Magnetic susceptibility, Iron sand, Pasia Jambak Beach, Bartington Magnetic susceptibility Meter type MS2B.*

IDENTIFICATION OF ROCK TYPES FROM IRON SAND AT PASIA JAMBAK BEACH, PADANG, WEST SUMATERA

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Abstract. West Sumatera is a region that has an abundance of natural resources in the form of iron sand, one of which is in the area of Pasia Jambak Beach, Padang. Pasia Jambak Beach is one type of beach in rumps and sandy beaches (sandy beach), which has grayish-brown sand and rough grains on its surface. Iron sand could be formed due to weathering of rocks and materials found around the coast, such as old ships and others. This study aims to see the type rock of origin and the composition of the magnetic mineral elements found in the iron sand of Pasia Jambak Beach. The composition of iron sand-forming elements can be seen using XRF. The analysis results using XRF showed that the most dominant element in the samples was *Si* (Silica). Based on the SiO_2 vs K_2O diagram, it can be seen that the iron sand in the Pasia jambak Beach area comes from weathering of Basalt, Dacite, and Latite rocks. So, it can be concluded that the original rock group from iron sand at Pasia Jambak Beach is the Calc-Alkaline group (medium Potassium content) and High K Calc-Alkaline (high Potassium content).

Keywords: Iron Sand, Elemental Composition, Rock, XRF

Incorporation of Hybrid Corrosion Inhibitor with Epoxy Resin for Enhancing the Performance Properties of Organic Coatings

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Abstract. Hybrid corrosion inhibitor based on chitosan/silica (HCS) via ionotropic gelation technique by using sodium tripolyphosphate (TPP) anionic crosslinker agent has been developed. Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and energy-dispersive X-Ray (EDXS) analysis confirmed the intercalation structure and distribution of silica on the chitosan surface. Environmental scanning electron microscopy (ESEM) and transmission electron microscopy (TEM) revealed the co-continuous structure of silica on chitosan surface and the successful hybridization of chitosan and silica. A series of composite coating systems based on epoxy incorporated with prepared HCS (epoxy/HCS) were developed on the mild steel surface. The distribution of HCS within the epoxy matrix was characterized by ESEM and was found to be agglomerate accordingly to the loading fraction of HCS content. Moreover, the degree of transparency of developed coating systems was reduced accordingly to the HCS content as measured by UV-Vis spectroscopy. However, the degree of transparency of epoxy/HCS composite coatings has improved after exposure to corrosive medium as compared to the prior tests while decreased in NE coating. Electrochemical impedance spectroscopy (EIS) test for 60 days showed the impedance values of all epoxy/HCS composite coatings increased as the time elapsed and the composite coating system containing 0.8 wt.% of HCS (CS0.8) showed the most pronounced protectivity function with a high impedance value ($10^{10} \Omega$) at the 60th day of immersion.

Keywords: Corrosion inhibitor, coatings, chitosan, silica, EIStr

Quantitative EEG Analysis for Characterizing Complexity in Autism Spectrum Disorders

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Abstract. Autism Spectrum Disorders (ASD) are neurodevelopmental conditions characterized by deficits in social communication and interaction. People with ASD usually experience abnormalities in neural connectivity and changes in complexity. The complexity of electroencephalography (EEG) signals is believed to contain much information about the architecture of the neural networks in the human brain. This study aims to investigate the difference in complexity between ASD and control subjects by using a fractal dimension. The method consists of four steps: data preprocessing, wavelet decomposition of EEGs into five sub-bands (delta, theta, alpha, beta, and lower gamma), computation of fractal dimension, and Mann-Whitney statistical test. Two methods of fractal dimension analysis were used: Higuchi Fractal Dimension (HFD) and Katz Fractal Dimension (KFD). EEGs data were acquired during eyes-closed conditions using Emotiv Epoc+ 14-channel wireless EEG headset. Based on the results, it is found that there is a significant difference in the complexity between ASD and control, especially in the delta and gamma frequency bands.

Keywords: Autism Spectrum Disorders, EEG, Complexity, Higuchi Fractal Dimension, Katz Fractal Dimension

Need analysis of project based learning model and portfolio assessment in physics learning

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Abstract. Physics learning aims to equip students with knowledge, understanding, and ability in developing natural sciences. Basically, physics learning emphasizes physics concepts that are based on the nature of natural science concerning products, processes, and scientific attitudes. However, the difficulty of students in understanding, and applying the concepts of physics is a problem in learning physics. Project based learning model is a model that can develop students' ability to understand and apply physics concepts. The need for a project based learning model and portfolio assessment in physics learning is needed because it can facilitate teachers in the process and learning outcomes. This study aims to analyze the needs of the project based learning model and portfolio assessment. This research method is a qualitative approach, and the research was conducted in senior high school (SMA/MA) in the district of Padang Pariaman. The results of this study indicate that the project based learning (PJBL) model and portfolio assessment are needed because of the difficulty of students in understanding and applying student concepts in the teaching and learning process and because the project based learning and portfolio assessment models make it easier for teachers in the teaching and learning process.

Keywords: Physics learning, project based learning model, portfolio assessment

The Effect Integration of a Sustainability-Oriented Socio-Scientific Issue in the Chemistry Learning on Student's Environmental Awareness

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Abstract. This study evaluates the effects of integrating the Socio-Scientific Issue (SSI) of air pollution into chemistry learning on student's environmental awareness. A total of 60 students participated in the study and completed pre- and post-intervention surveys, as well as participated in group discussions. The integration was based on the use of a digital learning environment designed by the software Prezi. The learning environment introduced the components of air pollution, pollutants, the effects of air pollution on human health, the relationship between air pollution and acid rain. The integration of SSI in chemistry learning has enhanced students' communication and collaboration skills through the decision-making on problem-solving activities. Students also engaged in developing their environmental sustainability awareness and higher order thinking skills. As a result, the study revealed that SSI has a positive impact on developing a value-based learning environment in chemistry learning.

Keywords: SSI, chemistry learning, environmental awareness

AUTOMATIC TRANSFER SWITCH IN SOLAR CELL INVERTER SYSTEM BASED ON ANDROID APPLICATION

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Abstract. The main of power supply is PLN (State Electricity Generator) is not always continuous in its distribution, one day there will be blackouts which may be caused by disturbances in the transmission system or distribution system and the limited availability of fossil energy. This can result in disruption of human activities and productivity. The solution to this problem is to develop an Automatic Transfer Switch (ATS) in a hybrid system that utilized solar cell energy (new renewable energy) and PLN based android. This system will work automatically as a hybrid power plant that uses solar panels and PLN as its energy source alternately by utilizing ATS and monitoring and controlling remotely. The purpose of this study is to determine the effectiveness of using electric power at home and determine the performance specifications of the device with monitoring based android. The research is classified as a laboratory experiment, is research that applies science into a design in order to get performance as expected. Data collection techniques are carried out by direct measurement whose measurements do not depend on other quantities. Direct measurements are carried out by varying the electrical power needed by the house. From the result of measurements of current, voltage and power in the house and the yield of solar panels on the tool is in conditions of maximum harvesting of solar cells, the system will automatically drain the powers from the solar cells to the house and the rest to PLN. When the harvesting conditions of the solar panels are equal to the power needed by the house, the system will automatically supply power from the full solar cells to the house. When harvesting conditions are minimal from solar panels, the system will automatically supply power from solar cells and PLN to the house. So, the tool can run as expected and the power savings at home when using this system is 84%.

Keywords: Solar Cell, ATS, Hybrid, Android

Cold atom array for Rydberg quantum simulation

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Abstract. Atom, molecular, and optical (AMO) physics has led quantum information science and technologies for several decades due to its controlling of ideal quantum energy levels. Experimental realization of cold neutral atomic gas at tens of micro K enables quantum level control even with room temperature apparatus like lasers and anti-Helmholtz magnet. I will briefly discuss such experimental platform, magneto-optical trap (MOT) and a single-atom array of rubidium (^{87}Rb), for the application of the Rydberg quantum simulator.

Design Visitor Counter Using RFID Sensor for Monitoring The Number of Tourists

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Abstract. In this paper, we present a design for calculating the number of visitors to a tourist attraction. The tourism sector has a positive impact on national economic development. In an effort by the government to increase tourism potential, data on the number of visitors who visit a tourist attraction is needed. In this prototype, the number of tourists will be counted at the entrance using RFID. The controller unit (Node-MCU) will receive and process the incoming data and then classify it into local adult tourists, internasional adult tourists, local child tourists and internasional child tourists. Google Sheets are used to store data from the controller over a long period of time and provide results and records of daily visitors. Recording time on Google Sheets is delayed 3-4 seconds in good signal conditions, and 7-10 seconds on a bad signal conditions. This system provides accurate results about the number of tourists of a tourist attraction.

Keywords: Visitor counter, IoT, RFID

IDENTIFICATION OF MAGNETIC MINERALS IN DRY INK (TONER) AS THE BASIS OF MAKING DRY INK (TONER) BASED ON IRON SAND

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Abstract. Magnetite (Fe_3O_4) is part of a magnetic mineral that has many applications in various fields, both scientific and industrial, for example as a raw material for making dry ink (toner) in photo-copy machines and laser printers. At first dry ink (toner) was only made with a mixture of ordinary carbon, now the main raw material formula for commercial dry ink (toner) on the market generally consists of polymer, carbon black and magnetite. In this research, a series of analyzes have been carried out to identify the presence of magnetite which is used as a pigment or filler in dry ink (toner). The dry ink (toner) used is the type of Brother photocopy cartridge type TN2356, SAMSUNG ML2850, Fuji Xerox P115, HP 1028 and 85A and laser jet printer P1102. By doing several characterizations, namely magnetic characterization and non-magnetic characterization. The magnetic method uses the susceptibility method while the non-magnetic method uses *X-Ray Diffraction* and *X-Ray Fluorescence*. The results of the analysis showed that 4 types of dry ink (toner) containing magnetite (Fe_3O_4) were found in dry ink (toner) HP 1028, laser jet printer P1102, SAMSUNG ML2850 and HP 85A for the other 2 types of dry ink (toner) containing *Cerium oxide* CeO. The susceptibility values of each are; photocopy cartridge Brother TN2356 $9.50 \times 10^{-8} \text{ m}^3/\text{kg}$, SAMSUNG ML2850 $514.03 \times 10^{-8} \text{ m}^3/\text{kg}$, Fuji Xerox P115 $46.17 \times 10^{-8} \text{ m}^3/\text{kg}$, HP CP1025 $566.80 \times 10^{-8} \text{ m}^3/\text{kg}$, HP 85 $21153.47 \times 10^{-8} \text{ m}^3/\text{kg}$ P1102 laser jet printer $21194.77 \times 10^{-8} \text{ m}^3/\text{kg}$. with the size $<0,005\mu\text{m}$.

Keywords: Magnetic minerals, Magnetite (Fe_3O_4), Dry ink (Toner), Susceptibility, *X-Ray Diffraction*, *X-Ray Fluorescence*

The Effect of Sintering Temperature on Hydrophobic characteristic of Silica Manganese /Polystyrene (SiMn/PS) Nanocomposite

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Abstract. Currently a lot of research has been done on hydrophobic layers, but in its application the layer is easily damaged and is not corrosion resistant. Therefore, this research intends to decide the effect of variations in sintering temperature on the hydrophobic characteristic of SiMn/PS nanocomposite layers using a sintering temperature of 60oC, 100oC, 140oC, 180oC and 200oC for 1 hour using a furnace. This research uses HEM-3D (High Energy Milling Ellipse-3D Mention), XRD (X-Ray Difrraction) and SEM (Scanning Electron Microscope) tools. The precursor was made by giving 0.5 grams of polystyrene, 0.2 grams of silica powder and 0.2 grams of manganese powder. Coating is done by spin coating method. The results show that the SiMn/PS nanocomposite layer was hydrophobic based on the contact angle test. The highest contact angle has been obtained at a temperature of 600C. The contact angle is 104,70.

Keywords: hydrophobic, contact angle, durability, nanocomposite, SiMn/Ps

Practicality of Basic Electronics Module Integrating Creative Thinking in Diode Circuit Material and Its Application

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Abstract. The existing learning modules can develop students' understanding of material skills, but they are still general in nature and have not integrated creative thinking in them. The purpose of this study was to determine the validity and practicality of basic electronics modules integrating creative thinking in the diode circuit material and its applications. The research carried out includes the type of Research and Development, namely the development of basic electronics modules integrating creative thinking in the diode circuit material and its applications. The data collection instruments used were validation sheets and practicality test sheets by the lecturer. The product and data analysis techniques used were product validity analysis and product practicality analysis. The practicality value of the module by basic electronics lecturers with an average value of 91.5%. Based on this value, it can be argued that the basic electronics module integrates creative thinking in the diode circuit material and its application is already in the very practical category.

Keywords: Basic Electronics Module, Creative Thinking.

Solar Charged Controller Instrument with Maximum Power Point Tracking Method Based on Internet of Things

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Abstract. This research aims to get the maximum energy harvesting ability from solar cells and can also see the ability to harvest solar cells via the internet. Where previously we had to see directly the instrument to know its working ability. Energy harvesting uses the Maximum Power Point Tracking (MPPT) method and the Perturb and Observe (P&O) algorithm system. This method is effective to get maximum solar cell power. Meanwhile, the Internet of Things (IoT) system uses the ThingSpeak and App Inventor applications as data traffic. The module used to transfer data to the internet is ESP8266. The process of harvesting solar cell power will be difficult to monitor if you don't use IoT, therefore IoT makes it easier to monitor MPPT to get maximum power from solar cells.

Keywords: Solar Charged Controller, Maximum Power Point Tracking, Solar Cell, Perturb and Observe, Internet of Things

FABRICATION AND SURFACE CHARACTERISATION ON HYDROPHOBIC MORTAR CEMENT

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Abstract. This modern civilization is very dependent on cement mortar material. However, the nowadays problem is that the use of mortar is very vulnerable to environmental conditions become more often. Many buildings of mortar are corroded by salt solution and crack easily due to water penetrating the cement mortar. These problems are factors that contribute to the degradation of cement mortar. The durability of cement mortar has serious economic implications in the form of maintenance and replacement costs of a wall. Therefore, it is necessary to make a cement mortar that is water-repellent or hydrophobic. The purpose of this study was to fabricate and determine the characteristics of hydrophobic cement mortar made with various variations. Variations used are variations in the immersion composition of calcium hydroxide ($\text{Ca}(\text{OH})_2$) and variations in the composition of THF Tetrahydrofuran (THF) with Poliuretan (PU). This type of research were experimental. The independent variables were variations in the composition of $\text{Ca}(\text{OH})_2$ namely 10%, 20% and 30% and the molar variations of THF : PU were 5:6 molars, 1:10 molars, 0.1:10.9 molars with total for each variations were 11 molar. The control variables in this study were the composition of portland cement, aquades and silica sand 20-30 mesh with a ratio of 4:11:2 (according to SNI standards), cube cement mortar mold 5x5 cm, soaking time 7 days, heating temperature 60 °C, heating time for 1 hour and drying in the sun for 2 hours. The dependent variables are the contact angle and the cement mortar hardness value. The contact angle was measured using the sessile drop method and the hardness value using the vickers hardness tool. The result of this research is the successful fabrication of super hydrophobic cement mortar, with a maximum contact angle of 154°. The contact angle 154° occurs when the cement mortar is immersed with a concentration of 10% ($\text{Ca}(\text{OH})_2$) without being coated with THF:PU. The results also showed a decrease in the value of the contact angle from the addition of the PU concentration to THF and the immersion concentration ($\text{Ca}(\text{OH})_2$). From the results of the research, it was found that the optimum condition of hydrophobic cement mortar was at 10% ($\text{Ca}(\text{OH})_2$) immersion with a contact angle of 154.14 degrees and a hardness of 139,4 kg/cm².

Keywords : Mortar cement, hydrophobic, contact angle, hardness

Effect of Spent Coffee Ground Pretreatment with Natural Deep Eutectic Solvent (NADES) on Coffee Oil Yield

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Abstract. This study aims to identify spent coffee ground pretreatment with NADES solvent effect on coffee oil yield. The types of NADES used are choline chloride:urea, choline chloride:fructose, and choline chloride:glucose. Spent coffee grounds were pretreated and extracted using Ultrasound-Assisted Extraction (UAE) method. Pretreatment conditions were determined using statistical method response surface methodology at 1:10 (g/g) SCG:NADES ratio, 6 minutes on 55°C temperature. Then pretreated spent coffee grounds are extracted with n-hexane and separated solvent with coffee oil using a rotary evaporator. Pretreatment coffee oil yields are 17,6%, meanwhile the non-pretreatment yields only 13,53%. Fatty acid in coffee oil was identified using Gas Chromatography-Mass Spectroscopy (GC-MS). The fatty acid compounds from pretreatment coffee oil are palmitic acid (46,75%), linoleic acid (48,07%), and stearic acid (1,66%)

Keywords. Coffee, coffee oil, extraction, lignocellulose, NADES, UAE

Design Analysis, Sensor Response Test and Sensor Performance from Electrochemical Glucose Sensor Articles

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Abstract. Diabetes is a disorder of carbohydrate metabolism due to insufficient insulin production, it is characterized by increased levels of glucose in the blood or urine. Excess glucose in the blood can cause diabetes, therefore it is necessary to control glucose levels regularly. To control blood glucose levels, an appropriate and easy to use blood glucose level detector is needed by utilizing sensor technology. This study uses a literature review method, namely a systematic literature review. This literature review aims to identify and analyze data sets to determine sensor design, sensor response testing and sensor performance of the glucose electrochemical sensor. Many researchers have succeeded in designing glucose electrochemical sensors by modifying the Glassy Carbon Electrode (GCE) as working electrode from nanoparticle materials. The design of the glucose sensor that has been reported shows that the performance of the glucose electrochemical sensor is good. The sensor performance obtained is in the form of a wider linear response such as a glucose electrochemical sensor designed using Au-ZnO nanoparticles with a linear range of about 1-20 mM, a smaller Limit of Detection (2×10^{-4} mM) such as a glucose electrochemical sensor designed using Au-ZnO nanoparticles, higher sensitivity ($2.52 \times 10^3 \mu\text{AmM}^{-1}\text{cm}^{-2}$) such as a glucose electrochemical sensor designed using Cu_2O nanoparticles.

Keywords: glucose sensor, nanoparticle, electrochemical glucose sensor design, working electrode, sensor response

Design of Interactive Multimedia Based on Cognitive Conflict on Temperature and Heat Using Adobe Animate CC 2019

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Abstract. In the 21st century, the world of education is experiencing very fast development, it can be seen from the increasing use of science and technology in learning, which requires students to have 21st century skills. In addition, one of the objectives of learning physics in the 2013 curriculum to have a good understanding of concepts and principles. But in fact, there are still problems in understanding students' concepts that are still low, including on the material of temperature and heat. The solution given is to develop Cognitive Conflict-Based Interactive Multimedia. This study aims to determine the characteristics of interactive multimedia design and determine its validity. This type of research is Development Research using the Plomp development model which is limited to the preliminary research and prototyping phase to the stage expert review. The data obtained from needs analysis through filling out a questionnaire by 3 teachers and validity data obtained from 3 physics lecturers. The instruments in this study were teacher questionnaires, self-evaluation sheets and validity sheets expert. Data were analyzed descriptively. The research resulted in interactive multimedia designs with characteristics arranged according to 4 syntaxes of cognitive conflict-based learning models using the Adobe Animate cc 2019 application. The multimedia was designed to improve students' conceptual understanding of temperature and heat material and improve 4C skills. The results of the Self Evaluation show that multimedia is in the very good category. The results of the validity test obtained an average value of 0.803 which was in the very valid category. It can be concluded that the interactive multimedia design based on cognitive conflict on temperature and heat material has been valid so that it can be evaluated for the next phase.

Keywords: misconception, cognitive conflict, interactive multimedia, temperature and heat, adobe animate cc 2019

The Effect of Variation Calcination Temperature of Polystyrene/Tetrahydrofuran (PS/THF) Hydrophobic Layers on Contact Angle and The Compressive Strength of Cement Mortar

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Abstract. Infrastructure development in Indonesia continues to increase, this can be seen from the increasing number of buildings and housing. The house is an important building for humans, one of the important parts of the house is the walls made of bricks and covered with plaster. Its function, which can be used as plaster on walls, makes the authors use mortar as a sample in this study. The drawback is that the existing mortar is easy to grab because it absorbs air. Therefore, the author wants to make a waterproof mortar by providing a hydrophobic layer. This study aims to obtain the optimum value of the contact angle and compressive strength by varying the temperature as the independent variable used, namely 30°C, 60°C, 90°C, 120°C and 150°C. The results showed that the optimal contact angle was 120.7053° with a compressive strength of 258.19 kg/cm². The temperature relationship with the contact angle and the compressive strength of the mortar is the higher the temperature. The temperature relationship with the contact angle and the compressive strength of the mortar is the higher the temperature.

Keywords: : Cement Mortar, Polystyrene, Hydrophobic Coating, and Compressive Strength

Effect of Composition Variation Calcium Carbonate/Polystyrene (CaCO₃/Ps) on the Contact Angle of the Hydrophobic Layer and the Compressive Strength of Portland Cement

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Abstract. In the building there are several elements such as pillars, floors and walls. The wall is the outermost part of the building that directly receives changes in weather such as rain. As a result, the walls of the building are easily fragile and make the walls damaged. To reduce damage, it is necessary to test cement that is resistant to water (hydrophobic) so that the walls of the building are not easily damaged by water and durable with the help of hydrophobic agent additives in the form of CaCO₃ and polystyrene. The purpose of this study was to investigate the effect of variations in the composition of CaCO₃/polystyrene on the contact angle of the hydrophobic layer and the compressive strength of portland cement. This research uses a digital concrete compression machine, XRD and FTIR. Precursors were made by varying the composition of CaCO₃ and Polystyrene with a ratio of 1:3, 2:2, 3:1 and the calcination temperature used was 60°C using an oven. The results obtained that the optimum contact angle at the composition variation of CaCO₃ and Polystyrene 1:3 is 114.986° and the highest compressive strength of the mortar sample is obtained at variation 3:1, which is 238.10 kg/cm².

Keywords: Hydrophobic, Contact Angle, Compressive Strength, Cement, CaCO₃ and Polystyrene

Effect Of Acid, Salt And Base Immersion On Hydrophobic Properties Of SiMn/PS Nanocomposite

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Abstract. The manufacture of hydrophobic coatings that have self-cleaning properties has become a research trend now, but when applied, the coating is still easily damaged due to contact with other objects and is not durable due to corrosion. This problem will certainly hinder the application of hydrophobic surfaces in industry. For this reason, the researchers mixed substrates that had anti-corrosion properties such as silica and hard and strong properties such as manganese to be able to solve the previous problem, and the method used is spin coating. The precursors were made by adding 0.5 grams of polystyrene, 0.2 grams of silica nanoparticles and 0.2 grams of manganese nanoparticles. The coating was done by using the spin coating method and the calcination temperature was 60°C using an oven for 1 hour. The research results indicate that during immersion in an acid solution (pH 6), a salt solution (pH 7) and an alkaline solution (pH 11) as well as before immersion, there is a decrease in crystal size. For the best contact angle results obtained after immersion in acid is 97,277° with salt and base is 91,646° and 95,209° and before immersion is 104,702°. The results of characterization using FTIR functional groups have formed Si-O, Mn-O, C=C and CH. When immersing in a salt solution (pH 7) only the functional group C=C and CH showed polystyrene bonds. Durability testing is done by taking contact angles with different time intervals. The result of the contact angle for durability is decreased, in the first test and the second test with a distance of 3 days after the first test the results were 95.144°, 87.317°, 93.144°, before immersion 99.637°. The third test with a distance of 8 days got the results, 92.839°, 77.101°, 85.651°, before immersion 97.793°.

Keywords: hydrophobicity, contact angle, durability, pH, polystyrene, silica oxide (SiO₂), Manganese (Mn).

EFFECT OF COMPOSITION CaCO_3 /POLYURETHANE (PU) ON CONTACT ANGLE OF THE SURFACE AND COMPRESSIVE STRENGTH OF MORTAR

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Abstract. Infrastructure development, especially in the field of construction material technology, one of them is mortar. The water content greatly determines the energy performance and durability of the mortar. Water can enter building materials or mortar through rain. Damage caused by moisture is common, especially in areas with high moisture content. To solve this problems, a hydrophobic or water-repellent mortar was created, one of which was by using a hydrophobic additive, namely CaCO_3 /PU. The purpose of this research was to determine the effect of the composition of CaCO_3 /PU on the surface contact angle and mortar strength. This research uses spray coating method. The hydrophobic layer was made with various compositions of 5%, 10% and 15% and the carbonation temperature used was 60°C using an oven. This research resulted in optimum contact angle at 15% PU variation of 120.8936° and optimum compressive strength of 246.024 kg/cm² at 30% CaCO_3 immersion.

Keywords: hydrophobic, contact angle, compressive strength, CaCO_3 , Polyurethane, and mortar.

Optimization of Object Injection Current in the Development of Electrical Impedance Tomography for Bone Fracture Detection

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Abstract. Tomography impedance of electricity (EIT) nearly has all the parameters of the ideal of a modality tomography, such as high temporal resolution, functional, portable, the cost is relatively inexpensive, safe, does non-destructive, non-ionization and free of radiation. Electrical impedance tomography is unsatisfactory for an ideal parameter, namely the spatial resolution is still low, so researchers are always interested in carrying out various efforts to improve the spatial resolution of EIT, such as combining with other modalities, optimizing the data collection and acquisition system, and improving the performance of image reconstruction algorithms. However, the spatial resolution of the EIT is limited in the range of 5 percent to 10 percent of the object diameter due to the limited amount of voltage measurement data. Based on the advantages and disadvantages of EIT, the focus of application development does not determine the structural but functional of the object of interest. The novel application that will be developed in this research is to detect bone fractures, especially due to sports injuries. Optimization of the injection current according to the characteristics of bone as the most resistive object of all human body tissues for the development of this application has been carried out. The injection current is obtained from the conversion of the output voltage of a monolithic signal generator that has been given a voltage follower at its output. Meanwhile, the image is reconstructed from the voltage measurement data using the adjacent data collection method using the Newton-Raphson iterative algorithm with Tikhonov regularization. The optimization results are seen from the high quality and contrast of the reconstructed image for various injection current values. In the results of this research, the injection current that can produce the highest quality and contrast is 0.3 mA at a frequency of 10 kHz.

Keywords: Bone Fracture, Electrical Impedance Tomography, Current Injector, Data Collection Method, Data Acquisition System

Effect of SiMn/PS Composition on Hydrophobic Properties of Nanocomposite Thin Layers

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Abstract. Hydrophobic layer with properties corrosion and scratching are two difficult problems that hinder the application large scale in the industry. Therefore, the development of a Hydrophobic layer strong and durable as well as corrosion resistant with an easy method and efficiency is needed. The purpose of this study is to investigate the effect of variation composition to the contact angle of the hydrophobic layer of Silica Manganese/Polystyrene (SiMn/PS) nanocomposite. The composition of the SiMn nanocomposite used is 20:80; 40:60; 50:50; 60:40; 80:20. The characterization tool used is a DSLR Camera to take the contact angle and XRD to determine the crystal structure of the coating. The results showed that there was an effect of variations in the composition of SiMn/PS on the contact angle of the nanocomposite layer. The best contact angle is obtained at composition 50:50.

Keywords: composition, hydrophobic, contact angle, durability, nanocomposite, SiMn/Ps

Distribution of 4rd ICRLP 2021 Participants

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-  Universiti Kebangsaan Malaysia
-  Other / No value

