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Table of Contents Archive

SAFETY AND EFFICACY OF SILODOSIN-DUTASTERIDE IN THE MANAGEMENT OF BENIGN PROSTATIC HYPERPLASIA

G. Sadasiva Rao, K. Sudharani, Sk. Salma Sulthana, K. Sunita and M. Lakshmi Kranthi

DETECTION AND TRACKING OF DRONES USING ARTIFICIAL INTELLIGENCE TECHNIQUES - A SURVEY

Deepanshu Phartyal and Mihir Ghooi

GINGIVAL HERBAL DEPIGMENTATION: A NATURAL SOLUTION??

THE BASIC DIETARY REQUIREMENT OF DIFFERENT AGE GROUPS (AMAR) AND THE PRINCIPLES OF UNANI MEDICINE

Huma Noor and Sheeba Nuzhat Khan

EFFECT OF FLUORIDE CONTAMINATION ON MICROBIAL ENZYMATIC ACTIVITY IN SOIL

V. Roshni

TO EVALUATE THE OUTCOME OF ELASTIC NAILING ALONG WITH EXTERNAL FIXATOR IN OPEN TIBIA FRACTURES

K.K Pandey, Sparsh Naik and Ashok Vidyarthi

BMI COMPARISON IN DIABETIC HYPERTENSIVES VS DIABETIC NORMOTENSIVES

Mudasir S., Anjali N. Bhat and Sunil S.

ISOLATION AND CHARACTERIZATION OF PLANT GROWTH PROMOTING HALOTOLERANT BACTERIA FROM SALINE RHIZOSPHERIC ENVIRONMENTS

B. Sreelakshmi and B. Sujatha

COMPARATIVE EVALUATION OF DENTURE ADHESIVE ON THE EFFICIENCY OF COMPLETE DENTURE IN PATIENTS WITH DIFFERENT ALVEOLAR RIDGES AMONG KASHMIR POPULATION

Abrar Ahmad Hakeem, Shabir Ahmad Shah, Qazi shazana Nazir, Sandeep Kour Bali, Shazia Mir and Ubaid Iqbal Shah

EVALUATION AND QUANTITATIVE ANALYSIS OF BIOACTIVE COMPOUNDS FROM CHAETOCEROUS CALCITRANS AGAINST HUMAN PATHOGENS

Dooslin Mercy Bai and S. Kousik Saravana

DESIGN AND VALIDATION OF EDUCATIONAL THEORIES-BASED FRAMEWORK FOR E-LEARNING SYSTEMS

Sadia Ashraf

A LARGE HEPATIC HEMANGIOMA REVEALED BY EPIGASTRIC PAIN

Lotfi Azzouz, Laila Dahbi-Skali, Fatima Zohra Benmoula, Marouane Baiss, Mdaghri Jalil, Benamar Said, Mssrouri Rahal and Abdellatif Settaf

LYMPHOMATOUS TURN DURING GOUGEROT SJOGREN SYNDROME MIMICKING BREAST CANCER: A CASE REPORT

A. Assal, I. Elabassi, M. Bouslikhane, H. Boufettal, S. Mahdaoui and N. Samouh

ADRENAL NEUROBLASTOMA WITH BONE MARROW METASTASIS IN ANADULT: A CASE REPORT AND REVIEW OF THE LITERATURE

K. Raissouni, L. Benbella, A. Jahid, H.Ouazzani, Z. Bernoussi, K. Znati and F. Zouaidia

ESTIMATION OF SERUM CRP,FERRITIN,D-DIMER,LACTATE DEHYDROGENASE IN COVID 19 PATIENTS

K. Venkateswarlu, Ilaka Vasundhara Devi, R.S. Swaroopa Rani and Srirekha P.

APPORT DE LA GEOMATIQUE ET DES STATISTIQUES SPATIALES POUR LA CARTOGRAPHIE ET LANALYSE DES DEPRESSIONS EN LIEN AVEC LES POTENTIELS GITES LARVAIRES DANS LE DISTRICT SANITAIRE DE COCODY-BINGERVILLE

Felix Kouame Ndri, Adonis Krou Damien Kouame, Nicaise Aya Nguessan, Eric Valere Djagoua and Asseypo Celestin Hauhouot

CLINICO-HISTOPATHOLOGICAL STUDY OF ENDOMETRIUM WITH AND WITHOUT HORMONE THERAPY IN PATIENTS WITHABNORMAL UTERINE BLEEDING

Samridhi Allahbadi, Jyoti Mishra, Salony Mittal, Neerja Agarwal, Natasha Singh, Monal Trisal and Manjit Singh Bindra

GINGIVAL DEPIGMENTATION USING SIMPLE DE-EPITHELIZATION BY BUR ABRASION TECHNIQUE - A CASE REPORT

Manisha Verma, Mohammad Abdurrahman Khan, Anjani Kumar Pathak, Nand Lal, Shalini Kaushal and Aehad Ul Haque

PERCIEVED METHODS OF ENHANCING UTILIZATION OF SKILLED DELIVERY CARE SERVICES IN MUKUYUNI LOCATION, BUNGOMA COUNTY, KENYA

Wapukha W. Innocent

IS MY STETHOSCOPE HARMLESS? : OPERATING ROOM STETHOSCOPES UNDER MICROSCOPES

Youssef Halhoul, Hicham Hammadi, Achraf Jeddab, Ahmed Fakri, Ilyas Hmadate, Salah Eddine El Miskini, Abderrahmane Elwali, Mohammed Meziane, Mustapha Bensghir and Yassine Sekhsokh

PHARMACOLOGY IN ENDODONTICS

Shazia Siddiqui, Nurez Anwar, Rehan Ahmad Khan, Asmita Gupta, Sandhya Yadav and Anubha Srivastav

AN EVALUATION OF STREET CHARACTER AS A FACTOR FOR LIVELINESSA CASE FROM ISTANBUL

E. Abu Esleih and E. Akbalik

THE PREHENSIVE DIFFERENCES BETWEEN STUDENTS WHO ARE DEPRESSED AND THOSE WHO ARE NOT. A STUDY OF TEENAGER FROM AGE 15-19 YEARS OLD IN VARIOUS SCHOOL

Nene Pakkaporn and Peem Yanisa

ATTITUDE TOWARDS SARS-COV2 VACCINE AMONG DENTAL PROFESSIONALS

Meghashree Kerpala, Basavaraj S. Salagundi, Rupesh P.L, Arundati N. Raj, Ashika B.K, Manjusha P.C and Rohith Rajashekar G.R

THE EFFECT OF CONCENTRATION AND DURATION OF SOAKING ONION EXTRACT OF BATAK (ALLIUM CHINENSE G. DON) ON THE QUALITY OF LAMB MEAT

Nur Asmaq and Fachrina Wibowo

ACUTE EFFECT OF CYPERMETHRIN ON NUTRIENT UTILIZATION AND HISTOPATHOLOGY OF CLARIAS GARIEPINUS (BURCHELL, 1822)

Whenu Olusegun Olufemi and Mekuleyi Gabriel Olarinde

EFFECTIVENESS OF EDUCATIONAL INTERVENTION ON EMPOWERMENT OF SOFT SKILLS AMONG NURSING STUDENTS

Priya R. and Baba Vajrala

STEVENS-JOHNSON SYNDROME (SJS) AND TOXIC EPIDERMAL NECROLYSIS (TEN) ASSOCIATED WITH ANTI-TUBERCULAR DRUGS: A CASE REPORT

Gunapati Rama Mohan Reddy, Usha Kiran Prayaga and Sekhar Babu Bandar

THE ROLE OF TRANSCRANIAL ULTRASOUND IN THE EVALUATION OF HYPOXIC ISCHEMIC ENCEPHALOPATHY

Manoj Sharma, Narendra Kumar Kardam, Kushal Babu Gehlot and Shruti Gupta

FRENECTOMY - DIFFERENT TECHNIQUES

Mangesh B. Phadnaik, Mayuri Rajiv Ghike and Bhagyashree Shashikant Chavan

UNUSUAL PRESENTATION- MY BRAIN IS WET WITHOUT ALCOHOL: A CASE REPORT OF NON ALCOHOLIC WERNICKES ENCEPHALOPATHY

Abhishek Sharma, Smiti N. Panchal and Vidhi Thakkar

IMPACT OF THE COVID-19 PANDEMIC ON MEDICINE GRADUATION

Maria Luiza Sarmento Dos Santos, Ana Paula Dupuy Hermes, Beatriz Tambellini Giacomasso, Gabriela De Menezes Gagliotti, Jhonas Geraldo Peixoto Flauzino, Mariana Versiani Barreto, Paula Camelo De Alckmin, Paulo Henrique Fugi and Thiago Mito Romanelli Basso

REVIEW ON PHARMACOLOGICAL ACTIONS OF NYMPHAEA NOUCHALI

Lalita Dahiya, Rajesh Sharma and Sakshi Sharma

THE AGE OF GEO-POLITICAL APES: OUTCOME FOR INDIA AND THE EMERGENCE OF ECONOMICS AS SUPREME

Rashi Arora

IMPLEMENTATION OF THE WORKPLACE-BASED LEARNING MODEL (PBTk) TO IMPROVE THE QUALITY OF VOCATIONAL STUDENTS LEARNING OUTCOMES

Zulkifli, S.M.Tb. Abin, S. Supyan and C. Rianti

DETERMINANTS OF COMPETITIVE ADVANTAGE OF CONVECTION SMES TOWARDS DIGITAL TRANSFORMATION (CASE STUDY IN WEST JAVA PROVINCE)

Aguslim Suryana, Bambang Purwoko and Zulkifly

PSOAS ABSCESS: A RARE LOCALIZATION OF TUBERCULOSIS INFECTION

Lotfi Azzouz, Fatima Zohra Benmoula, Laila Dahbi-Skali, Marouane Baiss, Mdaghri Jalil, Benamar Said, Mssrouri Rahal and Abdellatif Settaf

PERCEIVED STRESSORS DUE TO ONLINE CLASSES

Kanika Kumar and Harneetpal Kaur

LESION VERRUQUEUSE ATYPIQUE DU PLANCHER BUCCAL : HYPERPLASIE VERRUQUEUSE OU CARCINOME VERRUQUEUX ?

Nawfal EL Hafidi, Mustapha Azzakhmam, Keith MFA, Ayoub Bakhil, Lahcen Khalfi and Karim El Khatib

ANALYZING FINANCIAL SOUNDNESS OF TATA COMMUNICATIONS

Aatish Joseph and John Benedict

STATUS OF SUMI WOMEN TEACHERS IN ZUNHEBOTO DISTRICT, NAGALAND: ISSUES AND CHALLENGES

Y. Inaholi Kiba and Sunny Joseph

AN UNCOMMON STEMI MASQUERADER: A CASE OF IMIPRAMINE INDUCED BRUGADA PHENOCOPY (BRP)

Kovvuri Hari Lalith Reddy, Gollapalli Sajit Kishan and A. Satyendra Kumar

MANAGEMENT OF HIGH BLOOD PRESSURE IN MOROCCO:WHAT PLACE FOR RGMPS ?

Chrifi Fatima-Zahrae, Assarag Bouchra and Idsalem Nassira

CARDIOVASCULAR SYPHYLIS PRESENTING AS AORTIC ANEURYSM, AORTIC CALCIFICATION AND AORTIC REGURGITATION - A RARE ENTITY IN THE ANTIBIOTIC ERA - A CASE REPORT

Gatram Pavan Kumar, Pradip Bhaumik, Ramachandradasar and Abhishek Chakraborty

EVALUATION OF CYTOTOXIC AND GENOTOXIC EFFECTS OF SAXAGLIPTIN

Ahmet Ali Berber, Nurcan Berber, Ibrahim Uysal and Nihan Akinci Kenanoglu

CUTANEOUS LEISHMANIASIS: A CASE STUDY

Al Enezi H. and Al Ghais N

TWINS - AN ALTERNATIVE OPTIMAL TOUR PLANS GENERATION METHOD TO TRAVELING SALESMAN PROBLEMS

R. Murugesan

USEFULNESS OF THERMO LABILE ALKALINE PHOSPHATASE AS A BIOMARKER IN DIAGNOSIS OF POST-MENOPAUSAL OSTEOPOROSIS

Narayana S. and Suresh Babu S.V

CURRENT ADVANCES IN DENTAL COMPOSITES- A REVIEW ARTICLE

Shweta Chaudhary and Siddhant Sachdeva

THE IMPACT OF COVID-19 ON THE GENERAL POPULATION REGARDING SOCIAL AND DAILY HABITS IN SAUDI ARABIA

Shatha I. Alqassemi, Noor N. Alazmi, Seham M. Alanazi, Latifah M. AlBatly and Salem D. Alsuwaidan

SCROTAL PILOMATRIXOMA: A RARE CASE REVEALED BY AN HYDROCELE

Salma El Majoudi, Ihssan Elouarith, Bernoussi Zakia, Znati Kaoutar, Ahmed Jahid and Zouaidia Fouad

BUDDHIST PHILOSOPHY AND ITS RELEVANCE IN DIGITAL AGE

D.V.S. Ganapathi Raju

PNEUMONIA SEVERITY INDEX COMPARED TO CURB-65 IN PREDICTING THE OUTCOME OF COMMUNITY ACQUIRED PNEUMONIA -A PROSPECTIVE STUDY
Rishna Ravindran, Rajani M., Manoj D.K., Muhammad Shafeek K. and Padmanabhan K.V

ADENOFIBROMATOSE MULTIPLE : A PROPOS DUN CAS

Meriem Haloua, Karam Saoud, Nizar El Bouardi, Badre Eddine Alami, Youssef Alaoui Lamrani, Mustapha Maaroufi, Hinde El Fatemi, Abdelaziz Banani and Meryeme Boubbou

TELENURSING - A REVIEW

Harshna Richard Qadir

CHANGES IN ANATOMY EDUCATION - AN OVERVIEW OF THE IMPACT OF SOCIAL MEDIA ON MODERN MEDICAL EDUCATION

Mathew Joseph, Brijendra Singh, Pooja Bhadoria and Rashmi Malhotra

A COMPARATIVE STUDY OF PROPOFOL AND THIOPENTONE WITH LOCAL ANAESTHETIC SPRAY AS INDUCING AGENTS FOR I-GEL INSERTION

Henal Jethi, Asit Kothari and Maunil Patel

THE EFFECT OF SYNBIOTIC ON CARCASS PERCENTAGE AND ABDOMINAL FAT PERCENTAGE OF NATIVE CHICKEN

Sri Setyaningrum, Dini Julia Sari Siregar, Ruth Riah Ate Tarigan and Warisman

INCREASING THE AVAILABILITY AND AFFORDABILITY OF TELEMEDICINE FACILITY IN THE TIMES OF PANDEMIC - CHALLENGES AND PERSPECTIVES

Anupma Srivastava and Shriya Bhatia

THE APPLICATION OF STEM-CP-BASED SOUND WAVE MODULE TO IMPROVE STUDENTS CRITICAL THINKING SKILLS AND INDEPENDENT LEARNING

Fani Aldilah Rosyadi, Sutarto, Jekti Prihatin and Indrawati

ANATOMIE DE LOREILLE INTERNE : LES CANAUX SEMI-CIRCULAIRE DAPRES UNE MODELISATION TRIDIMENTIONNELLE

Ismail Nakkabi, Mohammed Ridal, Najib Benmansour, Karim Nadour, Ali El Boukhari and Mohammed Nouredine El Amine El Alami

A STUDY TO ASSESS THE KNOWLEDGE REGARDING DENTAL HYGIENE AMONG SCHOOL GOING CHILDREN IN A SELECTED SCHOOL OF DELHI

Mala, Suparna Mill, Sapna, Kritika Grewal, Jitty Markose, Sakshi Aggarwal, Meghna Bisht and Aastha Jaswal

THYMOMA AS A NECK SWELLING - A SURGICAL DILEMMA

Shifa A. Kalokhe, Shaunak Saha, Lisha Suraj and Sameer Kadam

PREVALENCE OF DEPRESSION AMONG DIABETIC PATIENT ATTENDING PRIMARY HEALTH CARE CENTERS IN ALMADINAH ALMUNAWARA

Abdulaziz Abdulilah Alhaifi

DOES ULTRASONOGRAPHY GUIDED STEROID INJECTIONS PROVIDE BETTER OUTCOME IN SHOULDER IMPINGEMENT SYNDROME? A PROSPECTIVE STUDY

Harsh Kotecha, Ashok Ghodke, Alfven Vieira, Ameya H. Velankar, Akshay Mahajan and Mohit Issrani

ZOUGLOU, SOCIAL COMMUNICATION AND POLITICAL SATIRE IN COTE D'IVOIRE: EXAMPLE WITH TU SAIS QUI JE SUIS, LE PEUPLE TE REGARDE AND ON DIT QUOI BY YODE AND SIRO

Kouakou Oi Kouakou Benoit and Djedjess Atchory Albert

STUDENT OPINION ABOUT SCRIPT CONCORDANCE TEST, JEDDAH, KSA

Arif Abdulmohsen Almousa, Mohamed Hesham and Faisal Alghanmi

DEVIANT BEHAVIORS IN HIGHER EDUCATION AND PREVENTION AND INTERVENTION MODELS

Tran Thi Mai Phuong

HUMAN RESOURCES DEVELOPMENT AT MADRASAH ALIYAH WAY KANAN REGENCY

Muhammad Abrori, Wan Jamaluddin, Subandi and Muhammad Akmansyah

MULTIFOCAL TUBERCULOSIS OSTEOMYELITIS: A RARE PRESENTATION IN A 5-YEAR- OLD CHILD

El Mouhtadi Aghoutane, Amine El Khassoui, Tarik Salama and Redouane El Fezzazi

THE EFFECT OF INTERNAL CONTROL SYSTEM ON TAX EFFECTIVENESS THROUGH THE STRENGTHENING OF TAX OBLIGATION IN TAX SERVICE OFFICES IN MAKASSAR CITY

Ali Hanafi, Irawati H.M, Andi Masniah and Lidya Arlini

COMPARATIVE EVALUATION OF ALTERNATE EMERGENCY FIXATIVES

Rumaisa Pandit, Sanjeet Singh, Paramjit Singh, Nishant Singh and Kanika Sharma

TEXT SUMMARIZATION USING PYTHON NLTK

Bharti Deshmukh

ETHNIC POLITICS AND THE CREDIBILITY OF THE 2019 KOGI STATE GUBERNATORIAL ELECTION IN LOKOJA METROPOLIS

Innocent Jooji

A STUDY ON THE EFFECT OF COVID-19 ON EYE CARE AND ACADEMICS IN A TERTIARY CARE TEACHING HOSPITAL

K.S Rajiv Krishna M.S

T-SOFT - AN ADDITIONAL OPTIMAL TOUR PLAN FORMATION METHOD TO TRAVELING SALESMAN PROBLEMS

R. Murugesan

SEVERE PLASMODIUM FALCIPARUM MALARIA COMPLICATED BY ACUTE MYOCARDITIS(CASE REPORT)

Arif Abdulmohsen Almousa and Ahmed Soliman

ROLE OF COMPETITION COMMISSION OF INDIA IN PROTECTING THE INTERESTS OF THE CONSUMERS

Rita Pawan Bansal

A DESCRIPTIVE STUDY TO ASSESS THE KNOWLEDGE REGARDING DE-ADDICTION TREATMENT IN CLIENTS WITH ALCOHOL ADDICTION IN SELECTED COMMUNITIES OF GURUGRAM

Rebecca Dillu and Kanika Kumar

AUTOMATIC DEPUTATION: IMPACT ON POLICE FUNCTIONS

Archer Catipay Campoy and Jouhvyn Catipay Campoy

PRISE EN CHARGE DUNE SIALOCELEPAROTIDIENNEPOST-TRAUMATIQUE : APPROCHE FONCTIONNELLE, ET MINI-INVASIVE

Nawfal EL Hafidi, Keith MFA, Ayoub Bakhil, Adam Benbachir, Jalal Hamama and Karim EL Khatib

PROBLEM-ORIENTED FLIPPED CLASSROOM TEACHING PRACTICAL BASED ON THE KNOWLEDGE FRAMEWORK AS THE MAIN LINE - TAKE KETONE BODIES METABOLISM AS AN EXAMPLE IN BIOCHEMISTRY

Guo Liuyan, Hou Zhiling, Zhang Jingyi, Liu Weizhong and Liang Liqing

EFFECTS OF FOREST FIRE ON FOREST ECOSYSTEM, BIODIVERSITY AND LOSS OF PLANT AND ANIMAL SPECIES

Shailesh Tawade, Rinku R. Choudhary and Vaishnavi Santosh Chavan

INDUSTRIALIZED ANIMAL AGRICULTURE IS THE LEADING CAUSE OF GLOBAL WARMING LITERATURE REVIEW

Ar. Sushant Jaganade

LAST WILL AND TESTAMENT OF MANAS BATYR

Misirali Koldoshevich Koldoshev

RECURRENT ANTERIOR SHOULDER DISLOCATION TREATED BY OPEN INFERIOR GLENOHUMERAL LIGAMENT RECONSTRUCTION

Majde El Kawafi, Idris Ettajouri and Mabrouk Bohalfaya

SCOPE OF VARIOUS PHYTOCONSTITUENTS IN THE TREATMENT OF MULTIDRUG RESISTANT BACTERIA - A REVIEW

Gagandeep Kaur and Tamalika Chakraborty

CORRELATION OF DENTAL IMPLANTS SURFACE TEXTURE AND OSSEOINTEGRATION - A REVIEW ARTICLE

Shweta Chaudhary and Siddhant Sachdeva

EVALUATION DES PROPRIETES ANTIDIABETIQUES DE L'EXTRAIT AQUEUX DECORCES DE TRONC DE SCLEROCARYA BIRREA (ANACARDIACEAE) ET DE SA FRACTION CYCLOHEXANIQUE CHEZ DES RATS WISTAR DIABETIQUES DE TYPE 2

Anderson-Bel Justin Kouehiouon Djike, Camille Koffi, Ouga Stanislas Zahoui, Semi Anthelme Nene Bi and Flavien Traore

DAPSONE HYPERSENSITIVITY SYNDROME - A CASE REPORT AT TERTIARY CARE HOSPITAL

Sailajapriyadarsini Parlapalli, Sekhar Babu Bandar and Upendra Kumar Mudragadda

PHYTOCHEMICAL PROPERTIES AND IN VITRO ANTIOXIDANT ACTIVITY OF ACACIA NILOTICA (L.) WILLD. EXTRACTS

Dembele Bintou, Tounkara Fatoumata, Traore Nah and Dicko Amadou

CLASSIFICATION OF MAXILLOFACIAL DEFECTS: A REVIEW ARTICLE

Shirish Pawar and Pratiksha Somwanshi

PSYCHOSOCIAL FACTORS INFLUENCING SCHOOL DROP OUT AMONG MASAI BOYS IN MARGINALISED COMMUNITIES

Mary Kombich and Scolastica Kariuki-Githinji

STUCK UP!!!- CASE REPORT OF A RECTAL FOREIGN BODY

Shifa A. Kalokhe, Shaunak Saha, Mukesh Soni and Ali Reza

UMBILICAL COILING INDEX AND ITS RELATIONSHIP WITH PERINATAL OUTCOMES

Priyadarshini Adsul, Kishorkumar Hol, Shilpa Chaudhari and Sheetal Dube

A STUDY OF SERUM VITAMIN D LEVEL IN THE ADULT POPULATION OF DISTRICT SHOPIAN

Rais Ahmad Lone, Mohamad Imran Padder, Rifat Khan and Masrat Nabi

STUDY OF RADIOGRAPHIC FEATURES OF RENAL OSTEODYSTROPHY IN CHRONIC KIDNEY DISEASE (CKD) AND THEIR CORRELATION WITH CLINICAL AND BIOCHEMICAL PARAMETERS

Abhishek Mehta, Shahid Abbas and Utkarsh Balani

AN ANALYSIS TO STUDY THE FINANCIAL EMPOWERMENT OF WOMEN

Irshad Ahmad Malik, Khurshid Ali Ganai and Khalid Ashraf Chesti

EFFICACY AND TOLERABILITY OF ESLICARBAZEPINE ACETATE AS MONOTHERAPY IN PATIENTS OF NEWLY DIAGNOSED FOCAL EPILEPSY

Sonam Saxena and Seema Singh Parmar

A RETROSPECTIVE ANALYSIS OF GLUCOCORTICOSTEROIDS UTILIZATION AMONG PATIENTS WITH RHEUMATOID ARTHRITIS

Najlae El Ouardi, Laila Taoubane, Siham Sadni, Hajar El Hani, H. Julien Djossou, Mohamed Ahmed Ghassem, Abderrahim Majjad, Hamza Toufik, Asmaa Rezqi, Aziza Mounach, Lahsen Achemlal and Ahmed Bezza

CORRELATION OF BURNOUT DIMENSIONS AND SUBSTANCE USE AMONG TAIBAH UNIVERSITY MEDICAL STUDENTS IN AL-MADINAH AL-MUNAWARAH, SAUDI ARABIA

Afaf Mubarak Al Johani, Eyas Abdulqader Alrehaili, Faisal Essam Khalil and Ohood Mubarak Aljohani

CASTELMAN DISEASE REVEALED BY A GIANT ABDOMINAL MASS: A RARE CASE

Salma El Majoudi, Ihssan Elouarith, Zakia Bernoussi, Kaoutar Znati, Ahmed Jahid and Fouad Zouaidia

RAJAMO HANA KURAVANJI

Daniel Mortha

ANALYSIS OF REPEAT RADIOGRAPHY AND CORRECTIVE MEASURES IN TEACHING HOSPITAL IN TERTIARY HEALTH CARE CENTRE

Prashant Kumar Jha, Arshad Alam Khan and Himal Rai

CASE REPORT OF AN EPITHELIOID VARIANT OF KAPOSI SARCOMA: A RARE MIMIC OF ANGIOSARCOMA

Tawfiq Z. Allaylah, Abdulrahman E. Alraddadi, Abdulrahman M. Alrajhi, Ibrahim S. Alshaygy and Ahmed Alhumaidi

THE ATTITUDE OF SECONDARY AND SENIOR SECONDARY STUDENTS TOWARDS WRITING OFFLINE EXAMS DURING THE COVID PANDEMIC IN THE DELHI-NCR REGION

Manjusha Goel

A STUDY OF PROGNOSTIC SCORES TO PREDICT THE OUTCOME IN CEREBRAL VENOUS THROMBOSIS

Anusha Challa, Arunakumari Upputuri, Butchi Raju Garuda, Gopi Seepana and Sateeshkumar Talabhaktula

CLINICAL CHARACTERISTICS, MANAGEMENT PRACTICES AND IN-HOSPITAL OUTCOMES OF SCRUB TYPHUS PATIENTS IN A TERTIARY CARE CENTER IN THE NORTH EASTERN STATE, TRIPURA

Bibhas Shil, Susmita Rani Ghosh, Atharva Pandharipande, Bibhu Ranjan Das, Atanu Ghosh and Arunabha Dasgupta

PREDICTION OF MYOCARDIAL VIABILITY ON THE BASIS OF SERUMBNP AND HSTROPONIN I LEVELS IN PATIENTS WITH CORONARYARTERY DISEASEWITH LVSYSTOLIC DYSFUNCTION

Om Prakash Khoja, Yatendra Kumar Porwal, Sohan Kumar Sharma and Rajeev Bagarhatta

DETECTION OF GLYCINE AND SEROTONIN NEUROTRANSMITTERS BY HEXAGONAL BORON NITRIDE 2-D NANOSHEET

Shariful Islam, Mohammad Tanvir Ahmed and Farid Ahmed

INFLUENCE OF DENTURE ADHESIVES ON ORAL HEALTH QUALITY OF LIFE , OCCLUSION AND DISOCCLUSION TIMESOF DIGITALLY FABRICATED AND DESIGNED REMOVABLE COMPLETE DENTURES (CLINICAL CROSS OVER STUDY)

Eman Helal, Ahmed M. Esmat, Ayman F. Elawady and Maie F.F. Khalil

PREVALANCE OF DIABETES IN CATARACT PATIENTS AT TERTIARY CARE CENTRE

Usha B.R, Yugandhara Patade, Aparna Patel and Manjula T.R

ANESTHETIC CHALLENGE FOR PERIOPERATIVE MANAGEMENT OF ACUTE INTESTINAL OCCLUSION ON A 26-WEEK AMENORRHEA PREGNANCY: ABOUT A RARE CASE IN THE TROPICS

Wasso M.E, Sagboze Z.S, Mutombo M.D, Tshisuz N.C, Ilunga N.D, Kanyanda N.D, Teta M.I, Mukalay B.Y, Kaki B.B, Rhulinamungu M.F, Muteba K.P, Kujirabwinja K.J, Mulongo M.O, Isango I.Y, Manika M.M and Iteke F.R

COMPARATIVE EVALUATION OF CLINICAL AND MICROBIOLOGICAL PARAMETERS USING DIODE LASER (970 NM) AS AN ADJUNCT TO SCALING AND ROOT PLANING - A RANDOMIZED CONTROLLED CLINICAL TRIAL

Varsha V., Savita A.M, Pallavi K.N, Sunil S., Archana R.N, Remya R.M, Harsha M.B and Shivaprasad B.M

CORRELATION BETWEEN RISK FACTORS AND CLINICAL OUTCOMES FOLLOWING INTRAARTICULAR INJECTION OF AUTOLOGOUS PLATELET RICH PLASMA IN EARLY OSTEOARTHRITIS KNEE

P. Sisha, P. Thirunavukkarasu and K. Chitrrasu

A STUDY OF URINARY TRACT ABNORMALITIES: ROLE OF LOW DOSE MDCT UROGRAPHY

Shruti Gupta, Kushal Gehlot, N.K. Kardam and Manoj Sharma

EXPONENTIAL COMPARISON METHOD AND TFN FOR SELECTION OF REGIONAL SUPERIOR PRODUCTS BASED ON PROCESSED SEAWEED

W. Sudarwati, H. Hardjomidjojo., Machfud and D. Setyaningsih

UNIVERSAL TOWNSHIP OF AUROVILLE, INDIA - A UNIQUE EXPERIMENT

Supriya Nene

COMPARISON OF COPLANAR AND NON- COPLANARVMAT FOR BRAIN CANCER BY USING THE DOSIMETRICAL AND RADIOBIOLOGICAL INDICES

Wessal B.M. Hijazi, Amin El-Sayed Amin, Somaia Metwally El-Sayed and El-Sayed Mahmoud El-Sayed

CLINICO-MICROBIOLOGICAL STUDY OF PATIENTS WITH ACUTE EXACERBATION OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Talukdar Kakali, Chetia Kalpana, Saikia Giorgi and Chakravarty Atanu

RELIABLE ROUTING OF EMERGENCY DATA IN WIRELESS BODY AREA NETWORKS UNDER STATIC AND MOBILE SCENARIOS

Hemanth S.R and Sanjay Pande M.B

EWINGS SARCOMA - A CASE REPORT

Amitabh Verma

A BROAD REVIEW ON SHATAVARI (ASPARAGUS RACEMOSUS) : QUEEN OF ALL HERBS

Lalita Dahiya, Rajesh Sharma and Sakshi Sharma

HERBS - THE NATURAL ALTERNATIVE TO TREAT THE PERIODONTAL DISEASES

Tanu Sahney

IMPLEMENTATION STRATEGY OF SHEEP FARMING IN BEKASI REGENCY WITH INTEREST-FREE PARTNERSHIP MODEL USING SWOT ANALYSIS

Sodikun, Sukardi, Andes Ismayana and Elisa Anggraeni

COMPARISON OF LIPID PROFILE IN DIABETIC HYPERTENSIVES VS DIABETIC NORMOTENSIVES

Mudasir S., Anjali N. Bhat and Sunil S.

HEPATITIS AND COLITIS FOLLOWING COLOCYNTH INGESTION: A CASE STUDY

Alghais N., Abdulqader B., Alghanim M.G., Alenezi H. and Alrifae Y.

A STUDY ON ASSESSMENT OF EFFECT OF SAMYOGA VIRUDDHA AHARA CONSUMPTION ON METABOLIC SYNDROME IN 35 - 50 YEAR OLD MEN AND WOMEN OF MUMBAI

Ruqaiyah Kanchwala, Rekha Battalwar, Jagmeet Madan and Ajay T. Salunke

NUTRITIONAL ASSESSMENT ON ESRD PATIENTS USING SGA SCALE : A CROSS SECTIONAL STUDY

G. Manas Kumar, S.K Nadiya, K. Pravallika, T. Poojitha and V. Sravya

CUSTOMER RETENTION STRATEGIES AND PROFITABILITY AMONGST INSURANCE COMPANIES IN KENYA: A CASE OF LIBERTY LIFE ASSURANCE CO. LTD

Peter Bach and Kimani Gichuhi

MAYER ROKITANSKY SYNDROME: A CASE REPORT AND REVIEW OF LITERATURE

Oumaima Mhamdi, Sarah Boujida, Youssef Saoudi Hassani, Hajar Kandoussi, Aziz Baydada, Najia Zeraiid and Aicha Kharbach

THE IMPACT OF LONG-TERM FOLLOW-UP ON TOTAL HIP ARTHROPLASTY: A SYSTEMATIC REVIEW

Ali H. Al Asmri and Basil M. Al Rajhi

A COMPARATIVE STUDY TO ASSESS THE EFFECTIVENESS OF WARM WATER THERAPY VERSUS CONTRAST WATER THERAPY ON JOINTS PAIN AMONG ELDERLY PATIENT WITH ARTHRITIS IN SELECTED OLD AGE HOME AT DELHI NCR

Dilpreet Kaur, Lavanya Nandan and Sibi Samual

DEVELOPMENT OF A PROBLEM BASED LEARNING MODEL BASED ON SOCIO SCIENTIFIC ISSUES TO IMPROVE STUDENT CRITICAL THINKING SKILLS ON MATERIALS FOR ENVIRONMENTAL CHANGE AND CONSERVATION IN SENIOR HIGH SCHOOL

Nafi Tristiyani Putri, Indrawati and Wachju Subchan

COMPARATIVE EVALUATION OF ULTRASONOGRAPHY AND COMPUTED TOMOGRAPHY IN FOCAL LIVER LESIONS

Faizel A., Kardam N., Gehlot K. and Ola S.

OVERVIEWS ON RECYCLING OF POST-CONSUMER PET BOTTLES AND APPLICATIONS OF RPET

Lokesh Kumar

CLINICAL SPECTRUM OF HYPERTENSIVE EMERGENCIES WITH SPECIAL REFERENCE TO FASTING LIPID PROFILE

Upama Basumatary, Usha Rani Pegu, Mainak Roy and Uttam Kumar Nath

THE COMPARATIVE STUDY OF USG AND MDCT IN THE EVALUATION OF PELVIC MASSES IN FEMALES

Anupam Rajoria, Narendra Kumar Kardam, Kushal Gehlot and Sandeep Kumar Ola

CLINICAL PROFILE OF PATIENTS OF MEIBOMITIS - A HOSPITAL BASED STUDY, JHANSI

Jitendra Kumar and Archie Gupta

RETROSPECTIVE STUDY ON PRESCRIPTION PATTERN OF DRUGS USED TO TREAT PREGNANCY INDUCED HYPERTENSION AND OTHER COMPLICATIONS

P. Seetharamaiah, Unnava Naga Sai Vyshnavi Sugatri, Panthangi Pranathi, Muvva Bhavya and Devarapu Neelima Chowdary

PERCENTAGE OF COMPOUNDS CONSTITUTING THE TARFAYAS OIL SHALE (MOROCCO) REACTING TO ACID ATTACK (HCL)

Hafida Mokhlis and Abdeljabbar Attaoui

ETUDE DE COMPORTEMENT DU COLORANT TEXTILE ACIDE BLEU 74 DANS LE SOL PAR LA METHODE DE LIXIVIATION SUR COLONNE

R. Rakotobe, T.L. Randrianantoandro and O. Rakotoarinala

IS THE DIVERTICULAR PAPILLA A FACTOR IN THE FAILURE OF CANULATION OF THE COMMON BILE DUCT IN BILIARY STONES PATHOLOGY?

Salma Ouahid, Imane Radouane, Reda Berraida, Yasser Azali, Samir Mrabti, Ilham Elkoti, Ahmed Benkirane and Hassan Seddik

RARE UNILATERAL ADRENAL INFARCTION DURING PREGNANCY: A CASE REPORT

Boujida Sarah



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RESEARCH ARTICLE

**DEVELOPMENT OF A PROBLEM BASED LEARNING MODEL BASED ON SOCIO SCIENTIFIC
ISSUES TO IMPROVE STUDENT CRITICAL THINKING SKILLS ON MATERIALS FOR
ENVIRONMENTAL CHANGE AND CONSERVATION IN SENIOR HIGH SCHOOL**

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Abstract

This study aims to determine the validity, practicality, and effectiveness of the *problembased learning* model based on *socioscientific issues* on critical thinking skills in students. Changes in the global era in the development of knowledge and technology in the 21st century, especially related to the world of education in Indonesia. One of the explanations regarding the development of 21st century learning is critical thinking and problem solving skills, so a teacher must have innovation in learning. One of them is by developing an innovative *problembased learning* model based on *socioscientific issues*. This research is a development research using a 4D development research model which consists of four research stages, namely the definition stage, the design stage, the development stage, and the deployment stage. This research was conducted at Senior High School of Muhammadiyah 3 Jember, class X MIPA, academic year 2020/2021 with a total of 28 students, based on the results of the study to see the validity of getting validation results, namely 97.14% which stated very valid, to see practicality consisted of three things, first was the implementation of learning which got 82.3% results, second was the teacher response got 95.19% results, the third is the student response to get a result of 90.9%, the three things state that it is very practical, to see the effectiveness obtained from the test of critical thinking skills, the score is 81.5, which means it is very high. The conclusion from the results of the study states that the *problem based learning* model based on *socio scientific issues* is valid, effective, and practical to be used in improving students critical thinking skills.

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Introduction:-

Changes in the global era in the development of knowledge and technology in the 21st century, especially related to the world of education in Indonesia. Changes and renewal of the education curriculum occurred in 2013 which is generally known as the 2013 curriculum. The renewal of the learning process in the 2013 curriculum lies in learning that emphasizes the modern pedagogic dimension, namely using a scientific approach (*scientific approach*) (Wilsadkk, 2017). One of the explanations regarding the 21st century learning framework is the ability to think critically and solve problems. The ability to think critically will be able to make students assess whether a statement is indeed true and proven to exist or does it still need to be questioned (Julia, 2017). The demands of the 21st

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century make teachers must have ways to improve students' abilities in dealing with them. Based on the results of the needs assessment (needs assessment) for biology teachers, most said that the learning process for biology on the subject of environmental change and preservation is still dominated by teachers using the lecture method, whereas in the basic competencies in the 2013 curriculum required in these materials students must be able to analyze and solve problems (Nabila & Nana, 2019). The teacher-centered learning process results in students critical thinking skills do not develop because students only accept the material presented by the teacher in learning, so a teacher must have innovation in learning. One of them is the innovation of learning model development.

The learning model itself is a plan or a pattern that is used as a guide in planning learning in the classroom. The model is a general pattern of learning behavior to achieve the expected competencies or learning objectives (Darmadi, 2017). One of the learning model developed is the *problem based learning* model. *Problem Based Learning* is learning model who has problem based that uses real world problems as a context for students to learn about critical thinking in problem solving, as well as to acquire essential knowledge and concepts from the subject matter (Sardar, 2019). *Problem Based Learning* also presents a variety of authentic problem situations to students (Ceker&Ozdamli (2016). *Problem based learning* is learning that focuses on solving real problems, the process by which students carry out group work, feedback, and discussion (Restidkk, 2015). Based on the preliminary studies that have been carried out, *problem based learning* has a drawback, namely if students do not understand or are less interested in the material then students will find it difficult to solve problems and without student understanding as to why they are trying to solve the problem being studied, they will not learn. what they want to learn, thus requiring an approach that is able to increase interest and motivation in what they are learning. One approach that is expected to complete this is the *socio scientific issues* approach.

Socio Scientific Issues are dilemmatic or problematic issues where scientific knowledge (biology) and social awareness are interrelated with each other and present mental conflicts that require decision-making abilities to solve them. In order to make decisions, in addition to being based on scientific knowledge of science (biology), a person also involves a humanistic social perspective in the form of moral-ethical considerations (Yerdelendkk, 2018). *Socio Scientific Issues* can serve as a good learning context, enabling students to understand the importance of knowledge in everyday life and the surrounding environment so as to make the lessons learned by students more meaningful (Evagoroudkk, 2012). The importance of the *socio scientific issue* to provide meaningful learning situations for students so that they can apply their biological knowledge to the social atmosphere in the classroom so that it can affect the interest and motivation of students to find meaning in what they learn. The use of *socioscientific issues* can be used as a link to real problems in society and a basis for students to explore science content.

Problem Based Learning model and *Socio Scientific Issues* approach are in accordance with the current scientific approach. Both complement each other by looking at the needs of students in the 21st century, based on this statement by integrating the *Problem Based Learning* learning model based on *Socio-Scientific Issues* into learning can help students think critically, not only involving knowledge but also requiring attitudes and skills to respond and solve existing environmental problems, besides that, learning based on *Socio Scientific Issues* has the potential to support the development of intellectual abilities, communication skills, social attitudes, concern, and student participation as well as awareness of the relationship between science and social life (Gutierrez, 2015), with this learning model, it is hoped that it can improve students critical thinking skills which are the demands of the 21st century. research about *socio scientific issues* in learning have been carried out. However, learning based on *Socio-Scientific Issues*, especially at the SMA/MA level, is still a lot that has not been developed in a lesson. Based on this statement, further studies are needed to find out how learning using the *Problem Based learning* model based on *Socio Scientific Issues* can be applied validly, effectively, and practically at the secondary school level, in senior high school.

Research Method:-

This research is a type of research and development (Research and Development). Research and Development method is a research method that produces products that can be in the form of models, modules or others. This research design uses a 4D (four-D) development model developed by Sivasailam Thiagarajan, Dorothy S. Semmel, and Melvyn I. Semmel (Alfianika, 2018). The research is planned for the even semester of the 2020/2021 academic year. The place to carry out this research is at SMA Muhammadiyah 3 in the Jember area, East Java. The subjects of this study were 10th grade senior high school.

Data analysis technique:-

Validity:

Validity assessment requires data on the quality of learning model products obtained from the results of the validation of learning model products. The data obtained are descriptive and quantitative. Furthermore, the data from the validation results were analyzed using the percentage data analysis technique, with the help of the following formula :

V= validity
 \sum_{x1} = total empirical score
 \sum_{x2} = maximum total score

$$v = \frac{\sum x_1}{\sum x_2} \times 100$$

(Akbar, 2015)

The percentage data that has been obtained is then converted using an assessment category that refers to the validity criteria according to table 1.1.

Table 1.1:- Category Validity Assessment.

No.	Percentage (%)	Category	Description
1.	81,25 < x ≤ 100	Very Valid	The product is ready to be used in the field for learning activities
2	62,5 < x ≤ 81,15	Valid	The product can be continued by adding something less, the additions made are not too big and not basic
3	43,75 ≤ x < 62,50	Not Valid	The product is revised again with careful attention and re-examination
4	25,00 ≤ x < 43,75	Invalid	The product must be revised as a whole and fundamentally about the product content

(Akbar, 2015)

Student Critical Thinking:-

$$Value\ of\ Critical\ Thinking\ Skills = \frac{Score\ obtained}{Maximum\ score} \times 100\%$$

The category of critical thinking skills assessment is listed in table 1.2.

Table 1.2:- Critical thinking skills assessment category.

No.	Score	Category
1.	81,25 < x ≤ 100	Very high
2.	62,5 < x ≤ 81,15	High
3.	43,75 ≤ x < 62,50	Not high enough
4.	25,00 ≤ x < 43,75	Not high

(Akbar, 2015)

Results:-

Validity:-

The results of product validation are in the form of quantitative data obtained from the expert assessment (validator) of the product. The results of product validation can be seen in Table 1.3

Table 1.3:- Validation result assessment.

Instrument/Product	Validator	Result of Validation	Category
Learning Implementation Plan (RPP)	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer 2	95%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	96,25%	Very Valid

Learning Syllabus	Expert Lecturer 1	100%	Very Valid
	Expert Lecturer2	100%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	100%	Very Valid
The result grid student learning (pretest andposttest)	Expert Lecturer 1	93%	Very Valid
	Expert Lecturer2	95%	Very Valid
	Practitioner Tacher 1	97%	Very Valid
	Practitioner Tacher 2	95%	Very Valid
	Validation Average	95%	Very Valid
Learning Materials	Expert Lecturer 1	95%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	98,5%	Very Valid
Worksheet (LKPD)	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	99%	Very Valid
	Validation Average	97%	Very Valid
PIACCE learning model guide	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	99%	Very Valid
	Practitioner Tacher 1	100%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	97,25%	Very Valid
Critical thinking skills	Expert Lecturer 1	90%	Very Valid
	Expert Lecturer2	97%	Very Valid
	Practitioner Tacher 1	97%	Very Valid
	Practitioner Tacher 2	100%	Very Valid
	Validation Average	96%	Very Valid
The average overall validation		97,14%	Very Valid

The data in Table 1.3 shows the results of product validation from experts and practitioners, obtained an average value of 97.14% which is included in the very valid category. Based on the results of the product validation, it can be concluded that the product validation sheet can be used as a reference for validating the developed product.

Results of critical thinking skills:-

Table 1.4:- The results of the achievement score of critical thinking skills.

Meeting	Number of Students	Average critical thinking skills test result	Category
Meeting 1	28	77	High
Meeting 2	28	86	Very High

The data in Table 1.4 shows the results of the achievement scores of students critical thinking skills, there are 2 meetings and the average score at meeting 1 with a score of 77 indicates a high category, while at the second meeting a score of 86 indicates a very high category. These results indicate an increase in the achievement of students critical thinking skills during learning after using a *problem based learning* model based on *socio scientific issues*.

Discussion:-

Based on the results of the research that has been done, there are validation results and results from critical thinking skills. At the validation stage, it is expected to make learning tools more precise, effective, and tested. This validation stage is carried out by validators, validators in research on developing problem based learning models based on socio scientific issues consist of 2 expert validators (lecturers) and 2 users or practitioners (teachers). The validation results from the learning syllabus get an average of 100% with a very valid category, the validation results from the test questions of student learning outcomes get an average of 95% with a very valid category, the validation results from the learning materials get an average of 98.5 % with a very valid category, the validation results from student worksheets get an average of 97% with a very valid category, the validation results from the problem based learning model guide based on socio scientific issues get an average of 97.25% with a very valid category, and the results of the validation of critical thinking skills questions get an average of 96% with a very valid category, based on the overall results of the validity test get an average of 97.14% which states the category is very valid. These results state that the problem-based learning model product based on socio-scientific issues can be continued to the learning practice stage.

The next stage is to test students critical thinking skills using a problem based learning model based on socio scientific issues. There are 2 meetings to get the results. the first meeting got 77 results, while the second meeting got 86 results, there was an increase in the results of students critical thinking skills after using a problem based learning model based on socio scientific issues. besides that there were also changes in the way students communicate both in groups and alone, namely students are more critical in giving opinions, then from social attitudes, namely students are easier to interact and express their opinions, and student participation, namely students are more independent and dare to express their opinions according to the real truth.

Conclusion:-

Based on the research results obtained, the problem based learning model based on the socio scientific issue has met the valid, practical, and effective categories, then the problem based learning model based on the socio scientific issue can be applied in learning and can be used by teachers to help improve students critical thinking skills.

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