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Abstract Book

3rd International Conference on Advanced

STEAM

SCIENCE TECHNOLOGY ENGINEERING ART MATHEMATICS

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STEAM EDUCATION
EMERGING TRENDS & APPLICATIONS

Chairman's Message

It is a great privilege to extend a warm welcome to all distinguished guests and participants attending the 3rd International Conference on Advanced STEAM Education (ICASE-2025), hosted by *The University of Faisalabad*. The conference theme *"Connecting Technology, Arts, and Social Science for Shaping the Future,"* aptly captures the spirit of innovation and interdisciplinary collaboration that defines our institution's academic vision.

This international gathering provides a vital platform for leading scholars, researchers, and professionals to engage in thoughtful dialogue, share pioneering research, and explore emerging frontiers in STEAM education. Such exchanges are fundamental to advancing knowledge, inspiring creativity, and fostering solutions that address the evolving challenges of our world. At *The University of Faisalabad*, we firmly believe that true progress in education is achieved through the integration of diverse disciplines and perspectives. By bringing together experts from academia, government, industry, and research organizations, ICASE-2025 embodies our commitment to cultivating an environment where ideas flourish and innovation thrives. We are particularly encouraged by the active participation of young researchers and students, whose curiosity and dedication continue to drive the pursuit of discovery. I am confident that the experiences and connections forged during this conference will enrich their academic journeys and inspire them to contribute meaningfully to global advancement.

I extend my deepest appreciation to the organizing committee, distinguished speakers, and participants for their invaluable contributions to the success of this event. May ICASE-2025 serve as a beacon of intellectual exchange, collaboration, and inspiration for all.

With best wishes for a memorable and productive conference.

Mian Haider Amin
Chairman, Board of Governors
The University of Faisalabad

November 19-20, 2025, The University of Faisalabad, Faisalabad, Pakistan

Rector's Message

It is my honor and pleasure to welcome you all to the **3rd International Conference on Advanced STEAM Education (ICASE-2025)**, themed *"Connecting Technology, Arts, and Social Science for Shaping the Future"*.

This conference is dedicated to exploring and discussing the latest advancements and applications in STEAM education. It stands as a testament to our shared commitment to bridging minds across the globe through innovative technologies and groundbreaking ideas. The diverse disciplines within STEAM provide unique perspectives that, when integrated, pave the way for comprehensive and sustainable solutions to the complex challenges of our time. The dialogues and exchange of ideas at this gathering are not merely discussions, they are the seeds of progress that will continue to grow and drive future innovation. We are privileged to host a distinguished assembly of international and national scientists from various Higher Education Institutions (HEIs), research organizations, and professionals from federal and provincial government bodies, as well as the industry. They will be joining us as invited, keynote, and oral speakers, as well as session chairs and co-chairs. This event will not only enrich the research culture at TUF but also strengthen linkages and foster collaborations between counterparts in public and private universities and research institutions around the world.

The program of the 3rd ICASE-2025 offers an engaging blend of academic, professional, social, and cultural experiences. It welcomes researchers and policymakers from across the globe, whose expertise and insights will greatly enrich our sessions. For young researchers, in particular, this conference provides a valuable opportunity to enhance their scientific understanding by sharing and communicating their work within focused research themes. Active participation in discussions and sessions will further expand the reach and impact of this event.

We anticipate welcoming around 3500 international and national delegates and participants, including graduate students, young researchers, and faculty members. Over the course of two full days of technical, oral, and poster sessions, participants will find numerous opportunities for networking, collaboration, and professional growth.

I extend my heartfelt gratitude to all participants for their contributions and dedication to excellence. May this conference inspire us all to strive toward a future where the fruits of our collaborative efforts benefit humanity at large.

Wishing you all an inspiring, engaging, and productive experience at ICASE-2025.

Prof Dr Aman Ullah Malik
Rector
The University of Faisalabad

November 19-20, 2025, The University of Faisalabad, Faisalabad, Pakistan

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Oral Presentations

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Biochemical Profiling: Novel Insights for Scientific Innovations and Biomarker Discovery

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Biochemical profiling has emerged as a transformative approach for understanding complex biological systems, uncovering novel molecular mechanisms, and driving scientific innovation. By integrating advanced analytical platforms, such as spectroscopies with molecular and physiological data, biochemical profiling enables precise identification of metabolites and key biomarkers associated with stress tolerance, productivity, and quality traits. This multidimensional analysis not only elucidates the biochemical basis of plant responses to biotic and abiotic stresses but also provides a foundation for translational research in crop improvement, human health, and environmental sustainability. This keynote highlights recent advances in biochemical profiling and their application in biomarker discovery for early stress detection, metabolic pathway mapping, and the development of resilient and high-yielding crop varieties. Case studies will illustrate how biochemical fingerprints can be harnessed to bridge the gap between genotype and phenotype, facilitating marker-assisted selection and molecular breeding. Emphasis will also be placed on integrating metabolomics with genomics and proteomics to establish systems-level insights and predictive models of biological performance.

Keywords: Biochemical profiling, Biomarker discovery, Biological systems, Environmental sustainability, Biochemical fingerprints

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Biomedical Applications of Nanobiocomposites

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Bionanocomposites belong to the category of innovative materials synthesized from the fabrication of biopolymers with nano-fillers. The primary purpose of these materials hybridization is to improve the biocompatibility, biodegradability, thermo-mechanical stability and functional performance in bionanocomposite materials. In the field of biomedical sciences, conventional materials face some challenges. Biopolymers-based materials provide insufficient surface properties and mechanical stability that are essential for targeted drug delivery. On the other hand, materials based on synthetic polymers hold high mechanical strength but show low biocompatibility and are non-biodegradable, which could affect immune responses. The fundamental task is to introduce an innovative material that should have highly bioactive, robust mechanical properties and be biocompatible with the body, contributing to diagnostic and therapeutic purposes. The development of bionanocomposite materials mainly depends on the distribution of nano-fillers within the biopolymer moiety that creates potentially functional materials. Our research group focused on the development of different types of BNC for their diverse application. Different biopolymers were selected depending upon the application were selected e.g., collagen for tissue engineering, chitosan/alginate for drug delivery), while nano-fillers were used to decorate the BNC with required properties, like improving stiffness, antimicrobial properties and electric conductivity. The BNCs were also characterized by using different state of the art techniques along with a battery of biological and toxicological assays. These bio-nanocomposites gained a high position in the field of biomedical. Bio-nanocomposite scaffolds are manufactured in tissue engineering that function for tissue regeneration. Nano-fillers as controlled targeted delivery of the drug with high mechanical and anti-microbial potential.

Keywords: Nanobiocomposites, Biopolymers, Nano filters, Biomedical sciences, Targeted drug delivery

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Dietary and lifestyle Interventions to stimulate the Production of Stem Cells in Circulation for Sustainable Health

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Stem cells are unique multipotent cells capable of differentiating into various cell types based on the requirements of the body. Healthy circulation and proliferation of stem cells are essential for the human body to effectively address tissue repair and age-related challenges. Recent research indicates that the optimal practices of a healthy diet and lifestyle can enhance the mobilization of stem cells in circulation. The present study aims to review dietary and lifestyle interventions that can stimulate and promote the production of stem cells. Research findings reveal a strong urge to adopt a balanced diet rich in polyphenols, antioxidative vitamins, and minerals in the required daily dose. Vitamin D3, resveratrol, and omega-3 fatty acid supplements also promote the growth and activity of stem cells. To minimize the negative impacts of tissue damage and aging on health and to promote bone marrow to produce healthy stem cells, dietary intake must be improved. There is a strong need for healthcare practitioners to illustrate the impact of healthy dietary and lifestyle changes on patients. Additionally, we explored the impact of crucial lifestyle modifications on stem cell mobilization, such as physical activity, quality sleep, stress management, and avoiding smoking. Intermittent fasting and calorie reduction significantly improve stem cell health and function through autophagy. Incorporating these factors into daily routine can create a conducive internal environment for better differentiation and proliferation of stem cells. A healthy lifestyle and food changes also support the efficacy of cancer therapies. We recommend adopting the best possible lifestyle and diet interventions to address aging and combat chronic disease.

Keywords: Stem cells, Sustainable health, Multipotent cells, Intermittent fasting, Calorie reduction

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Unveiling the Therapeutic Potential: Insights into *Sisymbrium Irio* Seed Extract

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The plant-derived therapeutic chemicals may be an excellent source for drug development. The current study was undertaken to explore the diverse therapeutic potential of *Sisymbrium irio*. The methanol (SM) and aqueous (SA) extracts of *Sisymbrium irio* seeds were prepared by using a microwave-assisted method. The yields were 7.2% (SM) and 8.86% (SA). Total Phenolic Contents (TPC), Total Flavonoid Contents (TFC), and the DPPH radical scavenging activity were assessed. The TPC of SM and SA was 66.05 ± 0.15 mg GAE /mL and 37.26 ± 0.13 mg GAE/mL, respectively. The TFC of SM and SA were 19.097 ± 0.10 µg CE /mL and 11.16 ± 0.47 µg CE /mL, respectively. The SM sample showed the higher antioxidant activity ($42.24 \pm 0.29\%$) as compared to SA ($24.98 \pm 1.53\%$). Alpha-amylase inhibitory activity (anti-diabetic potential) was $54.14 \pm 0.21\%$ by SM and $23.67 \pm 0.39\%$ by the SA sample. The well diffusion method was used to measure the antimicrobial activity. The SM and SA extracts exhibited 17 mm and 16 mm zones of growth inhibition, respectively, against *Staphylococcus aureus* and in the case of *E. coli*, the SA extract showed no zone of inhibition, while the SM extract showed a 17 mm zone of growth inhibition. Fourier-transform infrared spectroscopy (FTIR) and high-performance liquid chromatography (HPLC) were used to identify the functional groups and structural characterization. Chlorogenic acid, vanilic acid, quercetin, ferulic acid, benzoic acid, cinnamic acid, p-coumeric acid, sinapric acid, and gallic acid were detected by HPLC. FTIR revealed the presence of sulfones, sulfonamides, alcohol, ether, alkanes, aldehyde, alkene, aromatic nitro, primary and secondary amines, amides, and sulphates. Structural characterization confirmed the presence of phytoconstituents that contributed to the therapeutic potential of *Sisymbrium irio*. However, further research to understand the underlying mechanisms is needed.

Keywords: *Sisymbrium irio*, Phenolics, Flavonoids, Alpha amylase, Antimicrobial

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Research Advances and Mechanistic Evaluation of Bioactive Compounds against Neurodegenerative Disorders

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The relentless progression of neurodegenerative diseases reflects a profound disruption in the brain's molecular equilibrium, where oxidative stress and inflammation converge to erode neuronal integrity. Amid this biochemical chaos, bioactive compounds have emerged as powerful modulators capable of restoring cellular homeostasis through intricate signaling interactions. Central to this molecular dialogue is the Nrf2 pathway, a master regulator of the antioxidant response and neuronal resilience. By activating Nrf2 signaling, bioactive compounds such as curcumin, resveratrol, and berberine reinforce the brain's intrinsic defense systems, counteracting oxidative insults and stabilizing mitochondrial function. This pathway-driven modulation not only diminishes reactive stress but also orchestrates cross-communication with inflammatory and survival networks, preserving neuronal function and synaptic stability. The molecular crosstalk between bioactive compounds and the Nrf2 axis thus represents a compelling therapeutic strategy against neurodegenerative disorders. Through precise regulation of cellular signaling, these natural molecules transcend conventional single-target approaches, offering a synergistic and sustainable route to neuroprotection. Such mechanistic insight deepens our understanding of how nature's chemistry interfaces with neuronal survival pathways, illuminating new directions for the prevention and treatment of neurodegenerative diseases.

Keywords: Neurodegenerative diseases, Nrf2 pathway, Inflammation, Cellular homeostasis, Intricate signaling interactions

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Antioxidant, Antidiabetic, Antimicrobial, Hemolytic and Enzyme Inhibitory Activities of *O. corniculata* Extracts and Chemical Fingerprinting

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Medicinal plants have been used for centuries in traditional medicine to treat various ailments. In the current study, a microwave-assisted technique was used to obtain *Oxalis corniculata* leaves methanol (OCM) and aqueous (OCA) extracts. Methanol and aqueous extracts yields were 9.3% and 17%, respectively. Total Phenolic Contents (TPC), Total Flavonoid Contents (TFC), and the DPPH scavenging potential were measured. TFC for the OCM and OCA extracts were 57.31 ± 1.68 μg CE/mL and 39.32 ± 0.98 μg CE/mL, respectively. The TPC were 19.99 ±0.56 mg GAE/mL (OCM) and 3.39 ± 0.04 mg GAE/mL (OCA). While DPPH scavenging activities were 40.26% (OCM) and 30.73% (OCA). An alpha-amylase inhibition assay was used to evaluate the antidiabetic potential. Methanolic and aqueous extracts showed 32.79% and 25.67% alpha amylase inhibitions, respectively. The agar diffusion method was used to measure the antimicrobial activity. Against *E. coli*, a 23mm zone of inhibition was exhibited by OCM. In the case of *S. aureus*, 20mm and 23mm zones of growth inhibition were observed for OCM and OCA, respectively. In the protein denaturation method, OCM and OCA showed 19.15 ± 0.35% and 12.50 ± 0.18% anti-inflammatory efficacy, respectively. In the hemolytic assay, OCM and OCA extracts showed 10.17 ± 0.56% and 2.04 ± 0.34% hemolysis, respectively, indicating a safer profile of the samples. Fourier-transform infrared spectroscopy (FTIR) and high-performance liquid chromatography (HPLC) were used for chemical fingerprinting. Gallic acid, caffeic acid, benzoic acid, chlorogenic acid, syringic acid, and cinamic acid were detected in the HPLC analysis. Primary and secondary amines, amides, carboxylic acid, alkanes, aldehyde, alkene, aromatic nitro, alcohol, ether, sulfones, sulfonamides, and sulphates were detected by FTIR. Altogether these findings recommend *Oxalis corniculata* as a promising source for bioactive products.

Keywords: *O. corniculata,* Hemolysis, Structural characterization, Anti-inflammatory, Antidiabetic

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Fruit Waste Valorization for Green Synthesis of Bioactive Nanoparticles in Food and Health Applications

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Fruit processing industries generate substantial amounts of byproducts, such as peels, seeds, and pomace, which are often discarded despite their richness in bioactive compounds, including polyphenols, flavonoids, and organic acids. In recent years, these fruit wastes have gained scientific attention as natural sources for the green synthesis of nanoparticles, offering an eco-friendly alternative to conventional chemical and physical methods. The bioactive constituents present in fruit residues act as natural reducing and stabilizing agents, enabling the formation of nanoparticles under mild, non-toxic, and energy-efficient conditions. This review consolidates current knowledge on the utilization of fruit waste extracts in synthesizing metallic and biopolymeric nanoparticles, highlighting their mechanistic pathways, characterization techniques, and functional properties. Particular emphasis is placed on the antioxidant, antimicrobial, and food preservative activities of these nanoparticles, which position them as promising candidates for applications in active packaging, food preservation, and nutraceutical delivery systems. Comparative analysis of synthesis methods and stability factors is presented, along with insights into scalability and safety considerations. Furthermore, the review outlines emerging trends in waste valorization, circular bioeconomy, and sustainable nanotechnology, bridging green chemistry principles with food and health innovation. By summarizing the advances and challenges in this field, the work underscores how fruit waste-derived nanoparticles can transform agri-food residues into value-added functional materials aligned with the United Nations Sustainable Development Goals (SDGs).

Keywords: Fruit waste valorization; Green synthesis; Bioactive nanoparticles; Food and health applications, Sustainable nanotechnology

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Biochemistry
Poster Presentations

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Therapeutic Significance of *Aloe vera* in Combating Oxidative Stress

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Oxidative stress, caused by an imbalance between the production of reactive oxygen species (ROS) and the body's antioxidant defense mechanisms, is a key factor in cellular aging and the pathogenesis of various chronic diseases including cardiovascular disorders, diabetes, neurodegeneration, and cancer. In recent years, there has been growing interest in natural antioxidants derived from plants due to their effectiveness and minimal side effects compared to synthetic compounds. Among these, *Aloe vera* has gained significant attention as a medicinal plant with diverse biochemical properties and therapeutic potential. The antioxidant activity of *Aloe vera* is primarily attributed to its rich content of bioactive compounds such as phenolics, flavonoids, vitamins (A, C, and E), carotenoids, and anthraquinones. These molecules act as free radical scavengers, reducing agents, and metal ion chelators, thereby protecting biomolecules such as lipids, proteins, and DNA from oxidative damage. Several studies have demonstrated that *Aloe vera* extracts exhibit strong 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging and ferric reducing antioxidant power (FRAP), indicating potent reducing capacity. In addition, its polysaccharides enhance endogenous antioxidant enzymes such as superoxide dismutase, catalase, and glutathione peroxidase, providing further cellular protection. *Aloe vera* also contributes to wound healing, immune modulation, and anti-inflammatory responses, further supporting its therapeutic relevance. The biochemical understanding of these effects provides valuable insight into the development of plant-based nutraceuticals and pharmaceuticals aimed at preventing oxidative stress–related disorders. In conclusion, *Aloe vera* is a promising natural antioxidant source with significant clinical relevance, warranting further research to develop safe, cost-effective antioxidant therapies.

Keywords: Aloe vera, Oxidative stress, Reactive oxygen species, Antioxidant activity, cellular protection

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Therapeutic Potential and Health Benefits of *Putranjiva roxburghii*

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Putranjiva roxburghii, commonly known as the lucky bean tree or Putrajeevak, is a medicinal plant revered in traditional Ayurvedic medicine for its diverse therapeutic properties. Native to the Indian subcontinent, this evergreen species has been extensively used to address reproductive, inflammatory, dermatological, and febrile conditions. The seeds and leaves of *Putranjiva roxburghii* are rich in bioactive compounds such as isothiocyanates, glycosides, flavonoids, triterpenes, and saponins, which contribute to its pharmacological efficacy. Notably, isothiocyanates like isopropyl and butyl derivatives exhibit potent antibacterial, antifungal, and grain-preserving effects. Glycosides and flavonoids provide antioxidant and anti-inflammatory benefits, while triterpenes and saponins support immune modulation and hormonal balance. In Ayurvedic practice, Putranjiva is primarily used to treat infertility and enhance reproductive health. Seed powder mixed with milk is traditionally administered to improve sperm count and support uterine stability, especially in cases of recurrent miscarriage. Leaf extracts are employed to alleviate fever, joint pain, and skin disorders such as acne and burns. The plant's cooling potency and sweet post-digestive effect make it suitable for balancing Vata and Pitta doshas. Additionally, topical applications of seed paste are used for headaches and as a traditional antidote for snake bites. Despite its widespread traditional use, scientific validation of *Putranjiva roxburghii's* health benefits remains limited, necessitating further pharmacological and clinical research. Nonetheless, its integration into holistic wellness practices underscores its enduring relevance in natural medicine. These abstract highlights the plant's multifaceted therapeutic potential and its significance in Ayurvedic formulations.

Keywords: *Putranjiva roxburghii*, Health benefits, Bioactive compound, Infertility treatment

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Nutrigenomics: Personalized Nutrition Approaches for Preventing Diabetes in Pakistan

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Diabetes mellitus represents a growing public health problem in Pakistan, fueled by a multifactorial interplay of genetic susceptibility, dietary lifestyle, and lifestyle factors. Conventional dietary advice tends not to take into consideration individual differences in genes that can shape how nutrients are metabolized and utilized in the body. Nutrigenomics, protein-nutrient interaction, provides a new method for personalized nutrition through the adaptation of dietary advice according to the genetic makeup of an individual. This can potentially improve diabetes prevention and treatment by discovering genetic variants related to insulin resistance, glucose metabolism, and other pathways vital to the development of the disease. Within the Pakistani setting of increasing diabetes prevalence, nutrigenomics can optimize more successful dietary management by combining genetic information with culturally acceptable food habits. Individualized nutrition protocols can maximize glucose control and minimize diabetes complications by responding to the unique metabolic requirements of patients. In addition, the use of nutrigenomics may help healthcare providers create precision nutrition interventions that complement conventional medical therapies. Even though it holds a lot of promise, several hurdles in the form of inadequate genetic studies in multicultural Pakistani populations, inadequate infrastructure for genetic testing, and poor public awareness need to be overcome before nutrigenomic strategies can be entirely implemented. Nutrigenomics is an important bridge toward precision medicine and nutrition personalized in the context of the population's genetic and cultural background.

Keywords: Nutrigenomics, Personalized nutrition, Diabetes mellitus, Protein-nutrient interaction

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Polyherbal Nanoformulations: A New Frontier in Anticancer, Antibacterial and Antioxidant Therapies

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Polyherbal extracts were prepared by the maceration method using different solvents and were then used to synthesize zinc oxide nanoparticles. Different solvents like ethanol, hydroethanol, and distilled water were used for green synthesis. ZnO nanoparticles synthesized from hydroethanol and ethanol extracts exhibited sharp peaks at 372 and 384 nm, respectively, but those of the distilled water extract displayed a sharp peak at 327 nm in UV-visible analysis. Alcohols, carboxylic acids, alkanes, alkenes, and isothiocyanate were the main functional groups found analyzed by FTIR. Scanning electron microscopy (SEM) demonstrated a spherical morphology of the synthesized nanopaarticles. Zeta potentials for ZnO-NPs from ethanol, hydroethanol, and water extracts were determined to be 19.8 mV, -18.6 mV, and -16.1 mV, respectively. The sizes of the ZnO-NPs were found to be 167.76 nm, 473.9 nm, and 3508.8 nm, respectively. Then the Tuckey test was used for calculating the significant mean comparison. Ethanolic extract nanoparticles have the highest DPPH activity, while hydroethanolic extract have the significant TPC and TFC content. Ethanol nanoparticles have shown a significant zone of inhibition against *E. coli* and *Staphylococcus aureus*. Lowest MIC values were recorded in case of ethanolic extract nanoparticles and the highest in case of hydroethanol. Results of hemolytic activity and Ames assay indicate that these nanoparticles are non-toxic and non-mutagenic in nature. Results of anticancer activity against 3T3 and HeLa cell lines have shown that all of these nanoparticles are inactive against these cell lines, suggesting their promising anticancer activity. The nanoparticles synthesized from distilled water, ethanol and hydroethanol extracts of polyherbal product have a spherical shape with significant antioxidant and antibacterial activities. Cytotoxicity and anticancer studies suggest that these nanoparticles are non-toxic, non-mutagenic and have anticancer potential.

Keywords: Anticancer, Antibacterial, Cytotoxicity, Zinc oxide nanoparticles, Polyherbal product

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Phytochemical Evaluation and Effect of Bioactive Extracts of Mentha sp. On Analgesic and Anti-inflammatory Response in Animal Models

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Mentha longifolia has therapeutic potential as an antioxidant, antidiuretic, anticancer, antimicrobial, analgesic and anti-inflammatory agent. Powder of dried leaves of *Mentha longifolia* was used to prepare aqueous and methanolic extracts. These extracts' antioxidant activity, including TPC, TFC, and DPPH radical scavenging assay, was conducted using conventional techniques. While the aqueous extract had a slightly higher DPPH radical scavenging activity ($50.51 \pm 1.63\%$) and a higher total flavonoid content (108.07 ± 3.80 mg QE/g), the methanolic extract showed higher total phenolic content (358.02 ± 10.14 mg GAE/g). The capacity of *Mentha longifolia* extract to lessen paw oedema in an animal model was used to evaluate its anti-inflammatory properties. Extract demonstrated a trend towards decreased inflammation compared to the negative control, with slightly better efficacy observed at the lower dose (250 mg/kg) and via oral administration. *Mentha longifolia* extract had strong analgesic effects in the acetic acid-induced writhing test, especially when given by injection. The tail flick test further confirmed the analgesic potential of the extract of *Mentha longifolia* in mice. Both oral and intraperitoneal administration resulted in a significant, time-dependent increase in tail flick latency at 15- and 30-minute post-treatment, indicating potent antinociceptive effects. Finally, hematological profiling revealed that treatment with *Mentha longifolia* extract did not induce significant toxicity, with red and white blood cell counts remaining within or near normal ranges. A mild increase in red blood cells and platelet counts was noted, suggesting a possible hematopoietic benefit.

Keywords: *Mentha longifolia*, Antioxidant activity, Antibacterial

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Phytochemical Evaluation, Structural Characterization and Therapeutic Activities as Hepatoprotective and Nephroprotective Activity of Ficus sp. Extract

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Pakistan's diverse ecological environment supports the growth of numerous valuable medicinal plants, among which Ficus carica (fig tree) is particularly important due to its abundance of bioactive compounds and remarkable traditional medicinal value. It is extensively utilized in rural and remote regions as an accessible, effective, and affordable alternative to conventional allopathic treatments. In this research, aqueous and methanolic extracts were prepared from dried Ficus leaves to evaluate their antioxidant potential using TPC, TFC, and DPPH radical scavenging assays. Antibacterial activity was determined by the disc diffusion agar method, while albino rats were employed to assess hepatoprotective and nephroprotective effects. Diclofenac sodium was used to induce toxicity, and results were compared with standard drug treatments. Liver and renal function tests indicated near-normal readings, confirming safety. FTIR was used for structural characterization and HPLC for quantitative phytochemical analysis. Statistical analysis (one-way ANOVA, t-test; $p < 0.05$) confirmed significant therapeutic potential.

Keywords: *Ficus Palmata*, Antioxidant activity, Antibacterial, Structural Characterization, Hepatoprotective and Nephroprotective activity

Challenges and Molecular Barriers in Somatic Cell Nuclear Transfer (SCNT): Towards Improving Cloning Efficiency

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Somatic Cell Nuclear Transfer (SCNT) is a critical method in contemporary biotechnology for producing cloned embryos through the reprogramming of differentiated nuclei. Even with significant potential in regenerative and reproductive studies, the process continues to have very low efficiency, with much embryonic loss and developmental abnormalities. These are primarily due to the incompletion of epigenetic reprogramming, causing disruption of chromatin remodeling, transcriptional homeostasis, and nuclear mitochondrial coordination. Current studies suggest that aberrant DNA methylation patterns and heterogeneous histone modifications are responsible for early developmental failure in SCNT embryos. The failure of oocyte-retrieved reprogramming factors to eliminate somatic cell memory completely serves to restrict the achievement of totipotency. Methods to enhance nuclear–cytoplasmic compatibility and utilize targeted epigenetic regulators can improve the overall success rate of SCNT. Probing into the molecular processes facilitating effective nuclear reprogramming through genomic, transcriptomic, and proteomic analysis in future studies will likely untangle the molecular processes enabling effective nuclear reprogramming. Such developments would further strengthen SCNT's application in regenerative medicine, transgenic animals, and conservation of species.

Keywords: Somatic cell nuclear transfer, DNA methylation, Histone Modifications, Chromatin remodeling, Totipotency

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Nano Biochemistry in Early Cancer Detection: A Frontier in Personalized Medicine

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Early detection of cancer is vital for improving patient outcomes and increasing survival rates, yet it remains a significant clinical challenge. Nano biochemistry, an innovative fusion of nanotechnology and molecular biochemistry, is poised to transform early cancer diagnostics by offering highly sensitive and personalized detection methods. Through the use of nanoscale biosensors, targeted molecular probes, and cutting-edge bioanalytical techniques, this field enables the identification of cancer biomarkers with unprecedented precision. Nanomaterials such as carbon nanotubes, gold nanoparticles, and quantum dots, combined with biomarkers like proteins, microRNAs, and circulating tumor DNA, facilitate non-invasive, real-time monitoring of molecular and cellular changes from easily accessible samples like blood and saliva. This approach not only improves early-stage cancer detection but also supports the development of personalized diagnostic strategies tailored to each patient's unique genetic and epigenetic profile. By integrating these nano biochemical tools into clinical workflows, healthcare providers can shift cancer care from reactive treatment to proactive prevention, closely aligning with the principles of precision medicine. Despite these promising advances, widespread clinical adoption requires further research, validation, and regulatory approval. This presentation will explore recent breakthroughs, ongoing challenges, and future prospects, highlighting nano biochemistry's critical role at the forefront of personalized oncology and its potential to revolutionize cancer care worldwide.

Keywords: Personalized medicine, Biosensors, Nanotechnology, Biomarkers, Molecular diagnostic

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Therapeutic potential of CRISPR/CAS systems-A review

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Over the past few decades, genomic manipulation techniques have evolved from the early use of Zinc Finger Nucleases (ZFNs) and Transcription Activator-Like Effector Nucleases (TALENS) to the revolutionary CRISPR/Cas systems, which harness naturally occurring prokaryotic adaptive immune mechanisms. CRISPR/Cas9 has transformed genome editing due to its precision, efficiency, cost-effectiveness and ease of use. At the core of this system is the Cas9 nuclease, most notably SpCas9 from *Streptococcus pyogenes,* which, in conjugation with a single guide RNA (sgRNA), enables targeted DNA cleavage followed by DNA repair for precise genomic modifications. In comparison to the earlier genome editing tools like ZFNs and TALENSs, CRISPR/Cas9 offers improved accuracy, reduced cytotoxicity and simplified design. Advancements have led to variants such as SaCas9 and NmeCas9 for efficient in vivo delivery, as well as, catalytically inactive forms (CRISPR i/a) and base editors enabling precise nucleotide conversions without double-stranded breaks. This article discusses the classification of CRISPR/Cas systems, their versatility and significant advancements, ranging from the development of disease models and xenogeneic transplantation to therapeutic strategies for conditions such as type 1 Diabetes, Sickle cell disease, neurodegenerative disorders, cystic fibrosis and Duchenne muscular dystrophy. Recent innovations in CRISPR/Cas technology. -such as the emergence of smaller Cas9 orthologs, nuclease-deficient variants for transcriptional modulation, and base and prime editing techniques highlight its broad utility in both research and clinical applications. Despite its transformative potential, challenges remain, underscoring the need for continued refinement and comprehensive safety assessments.

Keywords: CRISPR/CAS, Gene therapy, Genetic engineering, Zinc finger nucleases

Biotechnology
Oral Presentations

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Application of an Indigenous, Low-Cost, and Sustainable Floating Treatment Wetlands Technology for Wastewater Treatment and Reuse

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In Pakistan, due to very high capital and operational costs of conventional technologies, > 99% wastewater is discharged in water bodies untreated. This wastewater contaminates the water, soil and food. To address this issue of high cost of wastewater treatment, a very low-cost floating treatment wetlands (FTWs) technology has been developed using locally designed and developed floating mat and available indigenous plants and microbes. FTWs is a low cost, sustainable, and environment friendly technology for wastewater treatment and reuse. It requires ~100 times lower capital investment than conventional technologies, without any operational cost. Until now, 500,000 sq ft FTWs have been applied at more than 100 sites in Pakistan and it improves the quality of about 500 billion cubic meters of wastewater annually, and sequesters 300 tons of carbon per year. It removes (up to 90%) both organic and inorganic pollutants from the wastewater, and treated water is being safely discharged in the environment or reused in agriculture and horticulture.

Keywords: Conventional technologies, Wastewater treatment, Floating treatment wetlands, organic and inorganic pollutants

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Photodegradation of Perfluorooctanoic Acid (PFAS)

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Perfluorooctanoic acid (PFOA), one of the most persistent per- and polyfluoroalkyl substances (PFAS), poses a critical global challenge due to its exceptional chemical stability, bioaccumulation potential, and resistance to conventional treatment methods. In recent years, advanced oxidation processes particularly light-driven photodegradation- have emerged as a promising strategy for PFAS mineralization. This keynote highlights current advances and challenges in the photodegradation of PFOA, emphasizing the design of photocatalytic materials with enhanced charge separation efficiency. Particular focus is given to transition-metal oxides and dichalcogenide-based nanocomposites, and carbon-based supports (graphene oxide and cellulose derivatives) that enable visible-light utilization and reactive oxygen species (ROS) generation. The talk discusses mechanistic insights into photogenerated electron-hole dynamics, degradation pathways, and the influence of surface chemistry, pH, and coexisting species on PFAS decomposition efficiency. The presentation concludes with perspectives on scaling laboratory-based photodegradation systems toward real-water applications, aligning with the United Nations Sustainable Development Goals (SDG 6: Clean Water and Sanitation, SDG 12: Responsible Consumption and Production).

Keywords: Photocatalysis, Perfluorooctanoic acid (PFOA), PFAS degradation, Graphitic carbon nitride, Environmental remediation

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Myco-synthesized Silver Nanoparticles: Antifungal Efficacy and SERS Profiling against *Aspergillus parasiticus*

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Myconanotechnology has gained significant momentum in current decades for producing high yields of key enzymes and secondary metabolites as natural reducing agents to reduce metal ions into nanoparticles. In the current study, synthesis of AgNPs have been evaluated by CRISPR-modified (M-AgNPs) and its parent *Aspergillus niger* (P-AgNPs). These AgNPs were characterized by UV-Vis spectrophotometer, FTIR, TEM, SEM and XRD analyses. The analyses revealed that the synthesized AgNPs have characteristic peak at 420 nm with surface plasmon resonance along with association of respective functional groups, spherical shape, crystalline structure, having average diameter of 8 and 11 nm, respectively. Furthermore, antifungal activities of AgNPs against aflatoxin producing *Aspergillus parasiticus* were evaluated, followed by the determination of MIC and MFC. The MIC of M-AgNPs and P-AgNPs were observed at 18.75 and 37.2 μg/ml, while MFC were 75 and 150 μg/ml, respectively. The biochemical changes in the fungal biomolecules were also investigated by SERS, showing an inclined pattern at higher AgNPs concentrations. The M-AgNPs exhibited higher antifungal activity against *A. parasiticus* as compared to P-AgNPs. The study first time describes the detailed SERS analysis of AgNPs against *A. parasiticus* that will help out to understand the mechanism of antifungal agents and their potential to control microbial infections.

Keywords: *Aspergillus niger*; *Aspergillus parasiticus*; AgNPs; MIC; MFC; SERS.

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Molecular Insights into Germin-like Proteins of *Brassica juncea*: Key Players in Biotic Stress Resistance

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Germin-like proteins (GLPs) are an important class of plant glycoproteins involved in defense responses to a wide range of biotic stresses. Despite their functional significance, the genomic diversity and defensive roles of GLPs in *Brassica juncea* remain largely uncharacterized. This study conducted a genome-wide identification and analysis of the GLP gene family in *B. juncea* and its progenitor species to explore their potential role in resistance to *Alternaria alternata*, the causal agent of Alternaria leaf spot disease. A total of 102 GLP genes were identified in *B. juncea*, along with 51 in *B. nigra* and 48 in *B. rapa*. Conserved motifs, domains, and gene structures were consistent across all species. Phylogenetic and synteny analyses revealed strong evolutionary conservation of GLPs between *B. juncea* and its parental genomes. Transcriptomic data highlighted 17 stress-responsive GLPs, of which 10 were validated through RT-qPCR following *A. alternata* infection. Five genes (*BjuGLP06*, *BjuGLP23*, *BjuGLP34*, *BjuGLP70*, and *BjuGLP97*) exhibited significant upregulation, indicating their critical involvement in pathogen defense mechanisms. This study provides the first comprehensive genomic and functional insight into GLPs in *B. juncea*, identifying promising candidates for the development of disease-resistant *Brassica* cultivars and contributing to sustainable crop improvement under biotic stress conditions.

Keywords: *Brassica juncea*, Germin-like proteins, Biotic stress, *Alternaria alternata*, Plant defense

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Nanomaterials for Plant Disease Diagnosis and Control

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Plant diseases are causing huge damage to agricultural crops around the globe and the loss in yield reaches 75% occasionally. Thus, reliable strategies to control the destruction caused by phytopathogens in agricultural farms are imperative. Several conventional diagnostic procedures to detect phytopathogens are used including serological, immunological and nucleic acid-based detection techniques. Many of these procedures have limitations such as requirement of prior knowledge about pathogens, low sensitivity and lack of detection of several plant pathogens simultaneously. The use of nanomaterials to sustainably control and timely diagnose plant diseases is largely neglected. Various nanomaterials have been extensively used in almost all fields of life; however, there is very limited knowledge and application of these nanomaterials for early diagnosis and control of plant diseases. Nano-sensors coupled with biomarkers could serve as efficient tools in plant disease diagnosis. Such sensors not only detect disease at early stage but also provide quantification of pathogens leading to devise effective control strategies. We developed functionalized CNTs that leverage both their magnetic properties and antibody conjugation capabilities to improve polymerase chain reaction (PCR) diagnostics of *X. fastidiosa*, a phytopathogen of pecan. The results indicate that CNTs significantly enhance efficiency for target capturing of *X. fastidiosa*, thereby increasing the sensitivity and reliability of pathogen detection compared to conventional DNA extraction methods and Dynabeads, a commercial immunomagnetic material. Moreover, we also synthesized green nanoparticles to effectively control various phytopathogens.

Keywords: Nanomaterials, Phytopathogens, Detection, Xyllela, Antimicrobials

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Chloroplast Transformation in Potato: Success Stories and Future Directions

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Chloroplast transformation offers several advantages including precise integration of transgene at pre-determined position of plastome via homologous recombination, no gene silencing and position effects, higher transgene expression levels by virtue of high ploidy level and no transgene escape though pollens by virtue of maternal inheritance making the transplastomic GMOs environmentally friendly and expectedly more acceptable han nuclear transformation. Potato (*Solanum tuberosum* L.) is a tuberous crop with utmost commercial importance around the globe. Potato chloroplast transformation was first reported in 1999 where *gfp* gene was expressed under Prrn promoter in a breeding line. Later in 2005, it was carried out in a commercial variety 'Desiree' using tobacco specific plastid transformation vector. Although they were able to obtain homoplasmic plastid transformants, yet the transformation efficiency was very low. Improvement in chloroplast transformation efficiency and expression in non-green plastids was reported in 2011 by employing potato specific chloroplast transformation vector and 5′-UTR of various plastid genes. In 2012, very high expression level (upto 41% of TSP in mature leaves) of a recombinant protein β-glucuronidase was reported in potato chloroplasts. In 2015, two thioredoxin genes were expressed and their expression was studied in amyloplasts. It was found that post-harvest light treatment increased the gene expression upto 55 times. In 2020, potato genome was transformed with tubulin-like GTPase gene *FtsZ1* from *Arabidopsis thaliana* and it was found that such nuclear transformants had macro-chloroplasts. It was expected that increased size of chloroplast would help in increasing chloroplast transformation efficiency. However, the results were otherwise. We report that an efficient and reliable *in vitro* regeneration of transplastomic potato (*Solanum tuberosum* L.) tissues paves the way to attaining high plasmic level of transgene in potato leaves.

Keywords: Chloroplast transformation, Transgene, Transplastomic potato, thioredoxin genes

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Evaluating the Potential of Bacteria in Remediation of Microplastics Contaminated Soil for Environmental Sustainability

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Plastic production and utilization have become ubiquitous around the world due to its durability, versatility, persistency and cost-effectiveness. However, poor plastic waste management and disposal methods such as open burning and landfilling lead to the generation of microplastics. These are the tiny plastic fragments that come into the environment from the breakdown of larger plastic objects that are < 5mm in size. These microplastics pose serious risks to the ecosystem health and community well-being by causing elevated carbon footprint, hampered soil aeration, water acidification, food web bioaccumulation, cardiovascular, developmental, and endocrine disruption. There are numerous studies on microplastics detection, but only a few discuss their bacterial biodegradation in soil and freshwater habitats. This study was aimed at exploring the detection as well as bacterial bioremediation of microplastics in agricultural soil collected from different areas of Faisalabad. The collected samples were treated with potent bacterial isolates *Lysinibacillus xylanilyticus and Enterobacter cloacae* to remove the microplastics contamination. Enzyme assays were performed and several degradative enzymes such as cutinase, lipase and protease were reported in the selected strains. The strains were tested to check their effectiveness in degrading polyethylene terephthalate (PET) and crushed plastic bottles. Bacterial degradation experiments were conducted in soil microcosms followed by microplastic quantification at regular intervals in control and treated samples. Our results demonstrated that the soil samples exposed to bacterial strains showed a significant reduction in microplastics. Hence, the selected bacterial strains showed strong ecological potential in combating microplastic pollution and nurturing sustainability.

Keywords: Plastic pollution, Microplastics, Microplastic extraction, Bacterial degradation

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Bioinformatics Tools for Biotechnology: From Genomics to Phenomics

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Bioinformatics, an interdisciplinary domain integrating computer science, mathematics, and biology, is crucial in contemporary biotechnology, especially in genomics, proteomics, and phenomics. This review examines the extensive range of bioinformatics tools and approaches employed in biotechnology, emphasizing their applications in drug development, gene therapy, agriculture, and industrial processes. Bioinformatics facilitates the management, analysis, and interpretation of extensive biological datasets, thereby advancing personalized medicine, functional genomics, and synthetic biology. The incorporation of high-throughput technologies, such as next-generation sequencing and mass spectrometry, has transformed data generation, facilitating more accurate and efficient biological analysis. Moreover, bioinformatics aids the progression from genomics to phenomics by enabling the systematic examination of phenotypic features and their association with genetic variation. It highlights the significance of artificial intelligence and machine learning in improving data processing, providing novel insights into intricate biological systems. Bioinformatics is crucial for the ongoing advancement of biotechnology, offering the computational foundation for advancements in agriculture, healthcare, and environmental preservation.

Keywords: Bioinformatics, Biotechnology, Genomics, Proteomics, Phenomics

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Biotechnology
Poster Presentations

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Harnessing the Acidic Phosphatases Production Potential of Soil-Borne Fungi from Wastewater Irrigated Fields under Shake Flask Method

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Indigenous fungal strains present in untreated wastewater of irrigated agricultural fields and agricultural soils could have synchronized their inherent potential to the local climatic conditions. Therefore, the fungal resident might develop their potential for producing various enzymes to handle the induced full organic load from toxic chemicals from textile industry and domestic wastewater. More than 50 fungal isolates were grown and isolated from soil samples collected from these sites using both soil dilution and soil culture plate methods. All the purified fungi were subject to phosphatase production test, from which only 14 fungal strains were selected as phosphatase producers. Among them only five fungi based on morphological similarities showed a higher phosphate solubilization index. These fungi are utilized for eco-cultural fine-tuning to harness their full production potential under shake flask (SF) methods. 250 µM para-nitrophenyl as substrate with 0.5 mL of inoculum size of the fungi, pH 4, temperature 30°C, glucose, and casein as carbon and nitrogen additive, with five days of incubation were found to be the most appropriate culture conditions for phytase production. *Aspergillus niger* and *Aspergillus fumigatus* showed initial ACD (5.9 Units/ mL 4.3 Units/ mL) and ACD specific activity (2.93, 2.55 Units/ mL per mg protein) during screening to be enhanced up to 19 ± 0.033 (Units/ mL), 16 ± 0.033 (Units/ mL), and $14 \pm 0.012, 13 \pm 0.066$ (Units/ mL per mg protein), respectively, with the above-mentioned conditions. ACD enzymes were almost stable for a wide range of temperatures (20-50°C); pH (3-6); highly sensitive to metals Mg^{2+}, Cu^{2+}, and Ca^{2+} ions and $EDTA^{4-}$, Ba^{2+}, Ni^{2+}, and Fe^{2+} inhibitors for ACD.

Keywords: Fungal acidic phosphatase, Eco-cultural optimization, Soil born fungi, Enzyme stability analysis, Aspergillus *niger*, *Aspergillus fumigatus*

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Transcriptomic Insights into *ZmHMA*-Mediated Cadmium Tolerance in Local Maize (*Zea mays* L.) Hybrids of Pakistan

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Cadmium (Cd) is a highly toxic heavy metal that disrupts plant growth and poses serious threats to global food security. Understanding plant tolerance mechanisms to Cd stress is crucial for developing resilient crop varieties. This study investigated the transcriptomic and physiological responses of the Heavy Metal ATPase (HMA) gene family in four local maize (*Zea mays* L.) hybrids—P1429, DK-6321, P-Shahkar, and T-307022, exposed to 50 ppm Cd stress under hydroponic conditions. Growth parameters, chlorophyll content, and *ZmHMA* gene expression were evaluated to assess tolerance mechanisms. Cd exposure caused significant reductions in root and shoot length, fresh and dry biomass, and chlorophyll a and b contents, reflecting oxidative stress and disrupted photosynthetic efficiency. Transcriptomic analysis via RT-qPCR revealed pronounced upregulation of *ZmHMA3*, particularly in roots, suggesting its role in vacuolar Cd sequestration and reduced Cd translocation to aerial parts. *ZmHMA2* expression also increased, contributing to Cd transport and metal homeostasis. Among the tested hybrids, P1429 and P-Shahkar exhibited superior tolerance with limited Cd accumulation in shoots, likely due to effective *ZmHMA3*-mediated detoxification. These findings highlight *ZmHMA3* as a key genetic determinant of Cd tolerance in maize and provide valuable insights for molecular breeding programs aimed at developing Cd-resilient cultivars to ensure sustainable production in contaminated agroecosystems.

Keywords: Heavy metal ATPase, Cd tolerance, Maize hybrids, RT-qPCR, Phytotoxicity

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Characterization and Comparative Analysis of *FLA12* Gene Associated with Root Morphology in Cultivated *Gossypium* Species

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Cotton is a major fiber crop which significantly effects the overall economy of the world and cultivated in more than 75 countries. There are many challenges that cause low yield of cotton, i.e. water limitation, economic losses due to many factors like abiotic and biotic stresses, and climate change. Among these challenges, low water availability is one of the main causes of its yield reduction. The plants with long sustainable roots and with an increasing number of lateral roots development can better survive the water stress and can give high yield. In this study, *FLA12* gene associated with lateral root number and root development was characterized in cultivated *Gossypium* species by using in silico techniques. The comparative analysis of root morphology of plants of different *Gossypium* species was grown in Cotton Stress Lab. In silico tools were used to find out the respective orthologs of *FLA12* protein in *Gossypium* species. Several analyses were performed to examine different structural features of *FLA12* gene and encoded protein. The prediction of domains, number of motifs, physiological and biochemical characteristics of orthologous *FLA12* proteins, number of introns and exons, and subcellular localization of protein was carried out, and conserved regions of orthologous proteins were identified. The evolutionary relationship among different orthologous *FLA12* proteins was studied through phylogeny analysis. This study revealed that all orthologous *FLA12* proteins were closely related during the course of evolution and *FLA12* gene was highly associated with lateral root numbers as the *Gossypium* specie which have highest number of orthologous *FLA12* proteins showed highest lateral root numbers. The number of nodes and primary root length was also observed to be highest in *Gossypium* plants containing highest number of orthologous *FLA12* proteins.

Keywords: Cotton (*Gossypium*), *FLA12* gene, Root morphology, In silico analysis, Comparative genomics

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Physicochemical Characterization of Off-Season *Capsicum annuum* and *Pisum sativum* Cultivated with Biocompost

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Organic waste production and management is one of the major concerns for the environment from the past few years and the world is focusing on the reuse of this component including agriculture as it is showing promising changes in the growth and nutritional entities of plants and land. Additionally, this organic waste in the form of composting reduces the reliance on landfills and boosts the fertility and productivity of soil and proves to be the best alternative to chemical fertilizers. Compost has proved an optimum approach and the research was conducted to investigate the efficiency of Biocompost on off-season growth of *Capsicum annuum* and *Pisum sativum* and to yield a resource efficient and ecofriendly organic fertilizer. This study involves the practice of microbial degradation under aerobic conditions to breakdown the waste organic substances into useful bio-compost which can be used as a bio-fertilizer. Mature humus in the experiment was used to assess the noticeable variation in physical appearance of plants. Results showed that the compost amendment led to a significant increase in height, off-seasonal budding, fruiting and growth of new plants. Along with that it proves good to sustainable waste management, better crop production and soil fertility. Biofertilizers enhance crop productivity and trigger off-season new growth with fruiting patterns and promote a better agricultural system. In this way, a green future can be secure with a sustainable environment and enriched biodiversity.

Keywords: Composting, Off-season, Waste management, Microbial activity, Bio-fertilizer

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Cytogenetic and Molecular Analysis of Primary Amenorrhea

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Amenorrhea is a menstrual disorder in females of reproductive age. It has two sub-classes: primary and secondary amenorrhea. Primary amenorrhea (PA) is either the absence of menstruation in females by age 15 with proper development of secondary sexual characteristics (breast development, pubic hair) or by age 13 without any development of secondary sexual characteristics. Its prevalence among women is predicted to be 1-2% and it has a serious impact on women's health. Cytogenetic abnormalities have been associated with primary amenorrhea. The most common causes of primary amenorrhea include genital tract abnormalities, gonadal dysgenesis and dysregulated levels of hormones. Variations and compromised function of kisspeptin (corresponding gene *KISS1*) and its receptor have been reported to cause menstrual dysregulation and primary amenorrhea due to reduced production of gonadotropin hormones (FSH and LH). This study was designed to investigate the cytogenetic profiles of PA patients visiting karyotyping lab, health biotechnology division, National Institute for Biotechnology and Genetic Engineering (NIBGE), Faisalabad. Hormonal alterations in primary amenorrhea patients were also investigated and selected PA patients having hypogonadotropic hypogonadism were subjected to sequence analysis of *KISS1* exon 2. The 100 primary amenorrhea patients recruited in this study ranged in age between 11-45 years of age. Cytogenetic abnormalities were observed in 22% of PA patients in this study with 45X Turner syndrome as the most prevalent abnormality. No mutation was found in exon 2 of *KISS1* gene in any ten PA patients having hypogonadotropic hypogonadism. This study highlights the importance of cytogenetic evaluation in PA patients so that the manageable cases can be given targeted treatment. It also reinforces the molecular characterization of hypogonadism cases to find the possible mutations in *KISS1* and its receptor.

Keywords: Amenorrhea, Menstrual disorder, Cytogenetic abnormalities, Molecular analysis, Gene *KISS1*

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Removal of Textile Dyes from Wastewater using *Tribulus Terrestris* and Its Nanocomposites with Zinc Oxide

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Textile industries generate about 2 lac tons of colorant perennial that are dumped in the lakes and streams and are a source of serious threats to mortal life. Textile dyes are mostly cancer and mutation causing by type. Numerous conventional manual and synthetic techniques are normally enforced to discard such pigments from the polluted water but they are not efficient, economical and environment friendly. Adsorption is the best technique to discard pigments from contaminated water by using biosorbents and nanocomposites. Due to their little size, large space place, extraordinary magnetic capabilities, and significant hazardous waste removal even at very minute amount, nanoparticles have attained increased interest in the wastewater treatment industry. As a result, we created *Tribulus terrestris* that was doped with zinc oxide (ZnODTTB) and *Tribulus terrestris* biosorbent (TTB) as absorbents for this work and assessed its adsorption capacity for the industrial pollutants, Congo red and Methylene blue dyes. A thorough study of the impact of wavelength, exposure time, pH, temperature, sorbent quantity, and colorant concentration of surface assimilation was conducted. UV-Vis spectrophotometer was used to study the optical density at different wavelength. It was observed, pH 7 was chosen as the ideal level for CR and pH 8 for MB, dye concentration (30mg/L for CR and 10 mg/L for MB), contact time (2 hours for CR and 1 hour for MB), the temperature of 35°C for CR and 45°C for MB, adsorbent dosage (0.5g/L for CR and 1g/L for MB) with acceleration of 120 rpm, the highest adsorption rate of 83.46% and 90.51% for CR and 79.71%, 88.50% for MB was observed from the solution onto the TTB and ZnODTTB surfaces respectively.

Keywords: Nanocomposites, *Tribulus terrestris* biosorbent, Adsorption capacity, Congo red, Methylene blue dyes

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Harnessing Lipid Nanoparticles for Precision Drug Delivery in Cancer Treatment

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Cancer remains one of the major causes of death globally, with traditional treatments confounded by systemic toxicity, reduced bioavailability and a lack of ability to target specifically malignant cells. Nanomedicine has emerged as a revolutionary means of addressing these limitations, with the lipid nanoparticles (LNPs) currently leading the precision drug delivery systems. LNPs provide distinctive benefits such as biocompatibility, surface chemistry tunability, and the capacity to package both hydrophobic and hydrophilic agents, including nucleic acids. Such characteristics facilitate enhanced pharmacokinetics, targeted delivery, and minimal off-target activity. We summarize the recent progress in the engineering of LNPs for cancer treatment, emphasizing strategies involving ligand functionalization for active tumor targeting, stimuli-responsive release modes, and combination therapies that include chemotherapeutic, immunomodulators, or genetic payloads. Several case studies on pre-clinical and clinical studies illustrate the translational value of LNP based formulation to address multi-drug resistance, enhance tumor penetration, and achieve better treatment outcomes. By closing the gap between laboratory discovery and clinical translation, LNPs are a promising platform to redefine the future of precision oncology.

Keywords: Lipid nanoparticles, Nanomedicine, Drug delivery, Cancer treatment

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A Review of Computational and Molecular Analysis for Combating Little seed Canary Grass (*Phalaris Minor*)

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Phalaris minor, often known as little seed canary grass, is one of the most destructive weeds that reduces wheat production worldwide. It may occupy wheat fields because of its aggressive spreading and competitiveness, which can result in a 50% yield loss in cases of severe infestations. Due to the widespread and frequent use of chemical herbicides, the situation has been made worse by the emergence of herbicide-resistant biotypes, which have made the majority of conventional management techniques useless. The need to create new, more sustainable management strategies is indicated by the escalating environmental problems linked to the overuse of chemicals. The molecular mechanism of herbicide resistance in *P. minor* is summarized in this review. While non-target-site resistance is associated with higher rates of detoxification through cytochrome P450 monooxygenases and glutathione-S-transferases, target-site resistance is primarily associated with mutations in the genes acetyl-CoA carboxylase (ACCase) and acetolactate synthase (ALS). The effectiveness of commonly used herbicides is significantly reduced by these intricate resistance mechanisms. The most recent advances in computational biology may now be used to investigate new herbicidal targets and rationally create potential chemicals. Methods that can find novel inhibitors and provide valuable information on protein-ligand interactions include virtual screening, molecular docking and molecular dynamics simulations. Moreover, bioinformatics-driven genomic and transcriptome research has expanded our understanding of resistance development and opened the door to marker-assisted selection in crop improvement initiatives. The usefulness of multidisciplinary techniques that combine biotechnology, computational biology, and agronomy is the final point of the current review. *P. minor's* resilience to herbicides, wheat output, and environmentally friendly weed control techniques will all be greatly aided by this kind of integrated framework.

Keywords: *Phalaris minor*, Herbicide resistance, Molecular docking, Computational biology, ACCase, ALS

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Artificial MicroRNA-Mediated Resistance against the Monopartite Begomovirus causing Cotton Leaf Curl Disease

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Cotton leaf curl disease (CLCuD) remains a major constraint to cotton production in Pakistan and north-western India, primarily caused by monopartite begomoviruses of the family *Geminiviridae*. Current commercial cotton varieties offer only moderate tolerance, emphasizing the urgent need for novel molecular resistance strategies. In this study, an artificial microRNA (amiRNA) approach was applied for the first time to confer resistance against Cotton leaf curl Multan virus (CLCuMuV) and related begomoviruses. Two amiRNA constructs, P1C and P1D, were designed based on the *Gossypium hirsutum* pre-miR169a backbone and cloned into the pGreen0029 binary vector under the CaMV 35S promoter. Transgenic *Nicotiana benthamiana* plants expressing these constructs were challenged with multiple begomoviruses, including CLCuBuV, CLCuKoV, PedLCuV, and ToLCNDV. PCR and Southern blot analyses confirmed viral detection and quantified resistance levels. P1C-expressing plants exhibited strong resistance to CLCuBuV, showing asymptomatic growth with minimal viral accumulation, while P1D conferred comparatively weaker protection. Resistance efficacy correlated with sequence complementarity between amiRNA and the viral V2 gene. These results demonstrate that the amiRNA strategy can provide efficient, potentially broad-spectrum resistance against monopartite begomoviruses. This approach highlights the promise of synthetic RNA-based technologies for sustainable crop protection and offers a foundation for developing virus-resistant cotton cultivars in Pakistan.

Keywords: amiRNA, begomovirus, Cotton leaf curl disease, Transgenic resistance, *Nicotiana benthamiana*

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Nanotechnology in Neurology: A Breakthrough in Treating Alzheimer's and Parkinson's

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Neurological disorders, Alzheimer's disease and Parkinson's disease are among the leading causes of disability worldwide. Recent estimates indicate that more than 55 million people worldwide live with dementia, with approximately 10 million new cases diagnosed annually. In Pakistan, it is estimated that nearly 400,000 people suffer from dementia, and Parkinson's disease affects about 1.2% of those over 65. These neurodegenerative conditions are primarily driven by the accumulation of abnormal proteins in the brain (amyloid-β and tau in Alzheimer's, α-synuclein in Parkinson's), oxidative stress, inflammation, and the gradual death of nerve cells. Current pharmacological treatments, Donepezil and Rivastigmine for Alzheimer's, and Levodopa for Parkinson's, offer only temporary symptom relief and do not halt disease progression. A major limitation is the inability of most drugs to cross the Blood-Brain Barrier (BBB), a protective wall that blocks entry of large or toxic molecules into the brain. Nanotechnology presents a promising solution to this challenge. Tiny drug carriers called nanoparticles can be engineered to safely cross the BBB and deliver medicines directly to the affected brain areas. A recent breakthrough showed that supramolecular nanoparticles used in Alzheimer's model mice were able to reduce amyloid-β levels by 50–60% within one hour of treatment, with major improvements in memory and behavior. This success highlights the high effectiveness and future potential of nanomedicine in treating neurological disorders. Although further human studies are needed, findings show that nanotechnology could become a powerful tool in managing and possibly curing diseases like Alzheimer's and Parkinson's in the near future.

Keywords: Nanotechnology, Alzheimer's disease, Parkinson's disease, Blood-Brain Barrier, Nanoparticles based drugs

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Nanobiotechnology in Anti-Aging Dermatology: A New Era of Skin Rejuvenation

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Aging is a complex biological process characterized by the gradual decline of skin structure and function, leading to wrinkles, fine lines, dryness, pigmentation, and loss of elasticity. Both intrinsic and extrinsic factors, including ultraviolet (UV) radiation, pollution, oxidative stress, hormonal imbalance, and reduced collagen synthesis, accelerate skin aging by damaging cellular components and impairing tissue regeneration. To mitigate these effects, an increasing number of individuals worldwide are turning toward anti-aging therapies aimed at restoring youthful appearance and enhancing skin health. Conventional treatments such as chemical peels, Botox, collagen fillers, and laser resurfacing often provide only short-term improvements and are associated with irritation, uneven tone, or tissue damage, thus limiting their long-term clinical effectiveness. Nanoparticle-based anti-aging therapies represent an advanced approach in dermatology and cosmetics, offering precise and effective skin rejuvenation. To overcome these problems, now focusing on nanobiotechnology-based anti-aging therapies. Nanoparticles such as liposomes, nanoemulsions, solid lipid nanoparticles (SLNs), and gold nanoparticles can carry active ingredients like retinoids, hyaluronic acid, coenzyme Q10, and antioxidants deep into the skin. These nano-therapies enhance absorption, stimulate collagen and elastin production, improve hydration, repair damaged cells, and reduce oxidative stress. Outcomes from clinical studies show that over 70% of users prefer these therapies due to long-lasting and visible improvements. Products like liposomal vitamin C serums and gold nanoparticle creams have achieved 60–80% enhancement in skin smoothness, elasticity, and tone. Although long-term safety requires further investigation, nanobiotechnology presents a promising frontier in anti-aging dermatology.

Keywords: Anti-aging, Nanobiotechnology, Vitamin C serums, Nanoparticle-based anti-aging therapies

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Epigenetic Therapeutics in Cancer: Mechanisms, Challenges and Emerging Strategies

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Epigenetics is the study of changes caused by the activation or inactivation of certain genes without altering the underlying DNA sequences. Key epigenetic mechanisms—such as DNA methylation and histone modifications—act as chemical marks that regulate gene activity, playing a vital role in mammalian growth, development, and cellular maintenance. These regulatory patterns, collectively known as the epigenome, can be disrupted, leading to abnormal cellular behavior. A notable example of such disruption is the progression of cancer. Cancer is characterized by dysregulation of critical cellular pathways, including proliferation, differentiation, and DNA repair. Imbalances in these processes can trigger a cascade of events, such as overexpression of oncogenes, suppression of tumor suppressor genes, and angiogenesis, ultimately leading to tumor initiation and metastasis. Recent research has identified epigenetics as a promising therapeutic avenue, complementing conventional treatments like chemotherapy, immunotherapy, and targeted therapies. Epigenetic drugs—including DNMT inhibitors (DNMTis) and HDAC inhibitors (HDACis) have shown efficacy in restoring tumor suppressor gene activity, particularly in hematologic malignancies such as acute myeloid leukemia, myelodysplastic syndromes, and cutaneous T-cell lymphoma. However, challenges remain in treating solid tumors due to issues like tumor heterogeneity and off-target effects. Emerging strategies, such as combination therapies and microRNA-based approaches, offer potential solutions. Given the reversible nature of epigenetic modifications, advancing these therapeutic strategies could significantly enhance treatment outcomes across diverse cancer types.

Keywords: Epigenetics, microRNA-based approaches, DNA methylation, Cancer disease

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Nano Particles: Wastewater treatment and pathogen control

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Water pollution is a major contributor to diseases such as cholera, typhoid, hepatitis A and E, and diarrhea. In Pakistan, approximately 70–80% of illnesses are waterborne. Conventional treatments like chlorination and filtration eliminate only 40–60% of contaminants and are ineffective against resistant pathogens. Nanobiotechnology offers advanced and efficient solutions for water purification. Nanoparticles such as silver (Ag), zinc oxide (ZnO), titanium dioxide (TiO_2), iron oxide ($FeSO_4$), and graphene-based materials have been synthesized using both chemical and green methods involving plant or microbial extracts. Their effectiveness was evaluated through adsorption, photocatalysis, and antimicrobial assays. Ag–TiO_2 nanocomposites demonstrated over 90% degradation of dyes and pathogens under sunlight. Graphene–ZnO hybrids effectively removed heavy metals like lead (Pb) and chromium (Cr). $FeSO_4$–chitosan nanocomposites enabled magnetic recovery, while carbon nanotube membranes eliminated up to 99% of bacteria. These nanoparticles function through reactive oxygen species (ROS) generation, photocatalytic activity, and adsorption. Despite challenges such as toxicity and cost, hybrid green nanomaterials show enhanced safety and stability. Overall, nanobiotechnology presents a sustainable, high-performance approach to wastewater treatment, with the potential to reduce water pollution by over 85–90%, thereby safeguarding public health and the environment.

Keywords: Nanobiotechnology, Water Pollution, Photocatalysis, Green Synthesis, Hybrid Nanomaterials

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Smart Farming with Nanobiotech: Toward a Greener Agricultural Future

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The rapid growth of the global population has intensified the demand for sustainable and efficient agricultural systems. Traditional agricultural practices, though productive, often rely heavily on chemical fertilizers and pesticides that cause environmental degradation, soil infertility, and water contamination. These limitations highlight a critical gap in achieving precision, sustainability, and resource efficiency in modern farming. Nanobiotechnology offers a transformative solution by integrating nanotechnology with agricultural biotechnology to create smart delivery systems for controlled and targeted applications. Nano-fertilizers and nano-pesticides enable slow and sustained nutrient or pesticide release, minimizing waste and environmental toxicity. Nanobiosensors further enhance precision agriculture by providing real-time monitoring of soil health, crop growth, and disease detection. Moreover, nanocarriers are being employed for plant genetic improvement, allowing efficient delivery of biomolecules to enhance stress tolerance and yield. Despite concerns about the long-term ecological effects of nanomaterials, ongoing research focuses on biodegradable and biosafe nano-formulations. Ultimately, nanobiotechnology bridges the gap between productivity and sustainability, paving the way for an environmentally responsible and technologically advanced agricultural future that ensures global food security.

Keywords: Nanobiosensors, Smart Farming, Food security, Nano-fertilizers, Nano-pesticides

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Comparative Genomics of Antibiotic Resistance: Uncovering Evolutionary Pathways across Bacterial Species

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Antibiotic resistance has become one of the most pressing global health challenges, diminishing the effectiveness of treatments and making infections harder to control in humans. This resistance arises from factors such as antibiotic misuse, incomplete treatment regimens, and horizontal gene transfer among bacteria. These pressures have enabled bacteria to develop sophisticated survival mechanisms against antibiotic exposure. Traditional research has primarily focused on studying antibiotic resistance within individual bacterial species. For instance, *Escherichia coli* and *Staphylococcus aureus* have been widely investigated for the presence of resistance genes such as β-lactamases and efflux pumps. However, these studies often provide a limited understanding of how resistance genes spread, interact, or evolve across different bacterial species. This study employs comparative genomic annotation to investigate antibiotic resistance across multiple bacterial species. Unlike single-species analyses, comparative genomics reveals both conserved and unique genetic traits, enabling the identification of gene transfer pathways and shared resistance mechanisms. Through bioinformatics-based annotation and network analysis, this approach aims to uncover genetic linkages and evolutionary patterns that contribute to antibiotic resistance. These comparative insights can help overcome the limitations of isolated studies and provide a clearer understanding of how resistance develops and circulates among microbial populations, contributing to improved strategies for antibiotic control and future drug development.

Keywords: Drug development, Comparative Genomics, Antibiotic Resistance, β-lactamases

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Green Synthesis, Characterization and Antimicrobial Evaluation of Rosin Nanoparticles against *Bacillus subtilis* and *Pseudomonas aeruginosa*

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Antimicrobial resistance (AMR) is an escalating global health crisis, contributing to approximately 4.95 million deaths annually and diminishing the efficacy of existing antibiotics. The resistance of key bacterial pathogens such as *Bacillus cereus, Bacillus subtilis, Escherichia coli,* and *Pseudomonas aeruginosa* to conventional antimicrobials underscores the necessity for alternative therapies. This study explores the green synthesis and antimicrobial potential of rosin nanoparticles (RNPs) derived from rosin gum, which was collected from *Cedrus deodara* (Deodar cedar). RNPs were synthesized using a dispersion & dialysis method and were characterized for their size and morphology. UV-Vis spectroscopy revealed a prominent absorption peak at 300 nm, while dynamic light scattering (DLS) showed a dominant particle size of 87.07 nm and a high polydispersity index (PDI = 0.990). Zeta potential analysis indicated a moderately stable negative surface charge (–27.9 mV), while XRD confirmed the crystalline structure of RNPs. Atomic force microscopy (AFM) revealed the smooth surface topography with an average roughness (Ra) of 2.042 nm. Fourier Transform Infrared Spectroscopy (FTIR) determined the key functional groups such as –OH (3392 cm^{-1}), C=O (1748 cm^{-1}), C–O (1204 cm^{-1}), thereby verifying successful nanoparticle formation. Furthermore, the antimicrobial potential of RNPs was assessed using disc diffusion and broth microdilution assays. RNPs exhibited increasing zones of inhibition up to 20 mm at a concentration of 20 mg/mL, with a minimum inhibitory concentration (MIC) of 5 mg/mL against *Bacillus subtilis* and *Pseudomonas aeruginosa*. The MTT assay also showed non-toxicity of RNPs for BHK-21 cells with promising cell viability at higher concentrations. These results affirm RNPs as safe, effective, and eco-friendly nanomaterials with strong antimicrobial potential. In future, the findings can be further extended against pathogenic bacteria such as *Escherichia coli*.

Keywords: Green synthesis; Rosin nanoparticles; *Bacillus subtilis*; *Pseudomonas aeruginosa*; Antimicrobial potential.

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Elucidating the Role of Nitrogen Regulator *are*A in Green Synthesis of Silver Nanoparticles by *Aspergillus niger*: A Comparative Study

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Mycosynthesis of nanoparticles (NPs) has emerged as a sustainable and eco-friendly strategy, offering a simple, biocompatible, and cost-effective alternative to conventional chemical and physical methods. Among filamentous fungi, *Aspergillus niger* is "Generally Regarded as Safe" and a versatile cellular factory for industrial metabolites. In nanoparticle biosynthesis, NADH-dependent nitrate reductase (NR) is often considered a key reducing agent, though recent studies suggest that formation of NPs may also occur independent of NR activity. In this study, the role of NR in silver nanoparticle (AgNP) biosynthesis was evaluated by targeting the *A. niger areA* transcription factor using a CRISPR-Cas9 expression system. Both parent (*are*A$^+$) and mutant (*are*A$^-$) strains were used for the biosynthesis of AgNPs and were comparatively analyzed. A distinct surface plasmon resonance peak at 415 nm confirmed the formation of AgNPs. X-ray diffraction (XRD) revealed typical face-centered cubic (fcc) crystalline AgNPs. Moreover, Atomic Force Microscopy (AFM) revealed that AgNPs synthesized by the parent strain (15.26 nm) were smaller in size and uniformly distributed than mutant strain AgNPs (57.33 nm). Zeta potential analysis showed colloidal stability with the value of –11 mV for both strains. The average hydrodynamic diameter (51.02 d.nm) further reflected better stability and dispersity in the parent strain AgNPs compared to the mutant (182.16 d.nm), respectively. While the Fourier Transform Infrared Spectroscopy (FTIR) spectra confirmed capping of NPs by fungal proteins and polysaccharides, indicating stabilization mediated by fungal biomolecules. These findings highlight the potential of *A. niger* as a reliable cellular factory for the green synthesis of AgNPs and provide new insights into the role of nitrate reductase-related pathways. In the future, these mycosynthesized AgNPs can be further evaluated for their antimicrobial potential and biomedical applications.

Keywords: Green Synthesis; CRISPR-Cas9; *are*A Transcription Factor, *Aspergillus niger*; Silver Nanoparticles

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Non-Synonymous Polymorphic Variant of *AP-2REP*, Impacting Protein Structural and Functional Stability

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Liver cancer is the third most common cause of death globally, accounting for 7.8% of deaths by cancer. Early-stage liver cancer is frequently asymptomatic and aggressive, hindering the timely and effective diagnostic and prognostic approach. Diagnosis at an advanced stage frequently makes liver cancer less curable, as it exhibits drug resistance. One of the most common genetic predispositions, single nucleotide polymorphism (SNP) has been linked to cancer pathogenesis. However, pathogenic impact of non-synonymous SNP variants of *AP-2REP* has not been evaluated yet in liver cancer development. AP-2REP belongs to the KLF family, acts as a transcription factor, and multiple targeted genes of *AP-2REP* are involved in cell cycle regulation, cell proliferation, cell growth and apoptosis. Hence, it is postulated that alterations in AP-2REP structure might impair the AP-2REP functions and interaction and could exacerbate the key cellular processes. This dysfunction may contribute to the development and progression of cancer. This study aims to investigate pathogenicity, structural and functional impairments induced by non-synonymous SNP variants of *AP-2REP* and to establish a relation to liver cancer susceptibility, development, and progression. Various computational approaches were employed to investigate SNP variants' effect on AP-2REP protein stability, structural and functional alterations. The most pathogenic non-synonymous SNP variant rs1257857115 (R397W) genotype was identified in 100 HCC patients and 100 healthy controls by employing tetra ARMS PCR. The SNPs in *AP-2REP* affect the protein's stability, structure, and function. There was a positive association between *AP-2REP* variant rs1257857115 genotype (TT) in HCC patients with higher susceptibility risk, in contrast, the protective role of wildtype genotype (CC) was found in healthy controls. Hence, it is concluded that *AP-2REP* variant rs1257857115 is significantly associated with HCC and can surge cancer development and could be used as a diagnostic biomarker in HCC.

Keywords: *AP-2REP*, SNP, Hepatocellular carcinoma, Cancer, Genotypes, Tetra-ARMS PCR

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Sustainable Microbial Approaches for Plastic Biodegradation: Impact on Human Health, Research Advancements, and Challenges

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The relentless accumulation of plastic waste poses a significant environmental and public health challenge, necessitating sustainable and innovative management strategies. Microbial biodegradation offers a promising avenue, harnessing the metabolic potential of microorganisms and their enzymes to degrade synthetic polymers into environmentally benign by-products. This review explores recent advancements in microbial approaches to plastic biodegradation, emphasizing mechanisms employed by native and engineered microbial strains to tackle persistent plastics such as polyethylene, polystyrene, and polyethylene terephthalate. Key developments in genetic engineering, synthetic biology, and bioinformatics have significantly improved microbial degradation efficiency, enabling integration into hybrid waste management systems. However, critical challenges remain, including scaling up processes for industrial applications, optimizing degradation rates, and ensuring the environmental safety of biodegradation by-products. This review provides a comprehensive evaluation of these barriers and examines the transformative potential of microbial biodegradation in aligning plastic waste management with circular economy principles. This approach mitigates environmental pollution, promotes human health, and advances global sustainability objectives by converting waste into value-added products.

Keywords: Biodegradation, Environment, Polyethylene

Computer Science
Oral Presentations

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Efficient and Ethical Use of Generative AI

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Generative Artificial Intelligence (GenAI) is reshaping the dynamics of education, research, and creative production by enhancing efficiency and expanding the boundaries of human innovation. However, its rapid adoption raises pressing questions about ethical use, authorship, and academic integrity. This presentation examines how educators and researchers can employ GenAI tools, such as ChatGPT, in ways that maximize productivity without compromising ethical standards. Drawing on practical case studies and institutional practices, including those from MIT, the discussion highlights balanced strategies for human–AI collaboration, effective prompt design, and responsible citation of AI-generated content. The talk concludes by outlining best practices and future directions for integrating GenAI ethically within educational and research environments.

Keywords: GenAI, Chat GPT, Human AI

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Multimodal Deep Learning Approaches for Human Activity Recognition

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Smart home systems that recognize and monitor human activity can be particularly beneficial for older adults with care needs, assisting with tasks, monitoring emergencies, and providing companionship. However, privacy concerns remain a significant challenge in developing such systems. This talk will explore how multimodal deep learning approaches can enhance activity recognition while minimizing the collection of personal data. By evaluating sensors from a privacy perspective, integrating multiple sensor modalities, and leveraging advanced deep learning techniques, it is possible to achieve high accuracy while preserving privacy. The discussion will also highlight how these technologies contribute to smart home systems that support healthcare personnel and caregivers by providing real-time activity insights and detecting abnormal behaviors.

Keywords: Explainable AI, Human activity recognition, Sleep Apnea, Multimodality, Computer Vision

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Investigating Prompt Sensitivity in Multilingual Large Language Models

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Large Language Models (LLMs) such as GPT, T5, and BART have demonstrated remarkable performance across diverse natural language processing tasks. However, their output variability in response to semantically similar but syntactically different prompts raises critical concerns regarding consistency, reliability, and reproducibility. This phenomenon, termed prompt sensitivity, poses a challenge for both scientific evaluation and real-world deployment, particularly in high-stakes domains like healthcare, legal systems, and education. This thesis investigates prompt sensitivity by quantitatively evaluating how different paraphrased inputs affect the responses generated by LLMs. The study leverages the BoolQ dataset, a benchmark for yes/no question answering, and applies the Prompt Sensitivity Index (PSI) — a dual-metric framework composed of Discrete PSI and Semantic PSI — to measure variations in model outputs. Discrete PSI captures output disagreement, while Semantic PSI measures embedding-based semantic drift across prompt variations.A comprehensive experimental setup was implemented using multiple transformer-based models (BART, T5, FLAN-T5), and prompt variants were systematically generated using paraphrasing techniques. The results demonstrate significant input-specific variability, with discrete disagreement rates as high as 36% in some cases, even when prompts were semantically identical. Visual analytics, statistical summaries, and error distributions are used to highlight model inconsistencies.The findings underline the need for improved robustness mechanisms in LLMs and suggest that prompt engineering alone is insufficient for ensuring consistent behavior. This thesis contributes a modular pipeline, reproducible codebase, and actionable insights to guide future research on model stability, fairness, and interpretability.

Keywords: Prompt sensitivity, Large language models, Prompt sensitivity index, Multilingual NLP, Model variability.

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A Next-Generation Framework for Alzheimer's Detection Using Multimodal Data and Explainable Federated Learning

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Alzheimer's disease (AD) remains one of the most pressing global health challenges, with early and accurate detection being critical for effective patient care and disease management. Traditional centralized machine learning approaches face limitations due to stringent privacy regulations, institutional barriers to data sharing, and the heterogeneous nature of multimodal medical data. To address these challenges, this study proposes a next-generation framework that integrates multimodal data and explainable federated learning (FedXAD) for privacy-preserving and interpretable Alzheimer's detection. The framework leverages diverse data sources—including magnetic resonance imaging (MRI), positron emission tomography (PET), cognitive test scores, and clinical records ensuring a comprehensive representation of disease progression. Federated deep learning enables collaborative training across distributed healthcare institutions without transferring sensitive patient data, while an explainable AI (XAI) module provides clinically meaningful insights into model decisions, enhancing transparency and trust in diagnostic outcomes. Experimental validation demonstrates that the proposed framework outperforms traditional federated learning and unimodal approaches, achieving high accuracy, precision, and recall across heterogeneous datasets. Furthermore, the explainability component highlights key imaging biomarkers and cognitive indicators, offering actionable support for clinicians. This study underscores the potential of multimodal, privacy-preserving, and explainable federated AI as a transformative pathway for next-generation Alzheimer's detection and collaborative healthcare innovation.

Keywords: Alzheimer's disease, Multimodal data, Federated learning, Explainable AI, Privacy-preserving healthcare, Medical imaging

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Blockchain-Enabled Secure Access Framework for Protecting Generative AI Prompt Data

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The rapid use of generative AI systems has introduced new privacy and security concerns related to prompt storage, access control and data misuse. Sensitive prompts, often containing confidential business information or personal context, can be exposed through poor access policies or malicious prompt injection attacks. To address these vulnerabilities, this study proposes a blockchain-based secure access framework that integrates cryptographic algorithms and dynamic access control models to protect generative AI prompt data. The system utilizes Role-Based Access Control (RBAC) and Attribute-Based Access Control (ABAC) mechanisms implemented through smart contracts to ensure that only authorized users can access or modify stored prompts. Each prompt interaction is cryptographically hashed using SHA-256 and recorded on a distributed blockchain ledger, providing immutability and verifiable accountability. Encryption and digital signatures further safeguard data confidentiality and authenticity. This framework not only prevents unauthorized access and tampering but also enhances transparency and traceability in generative AI systems. The proposed system establishes a reliable and accountable environment for managing prompt data while promoting ethical and responsible use of generative AI. The study demonstrates how combining blockchain and cryptographic techniques can create a trustworthy environment for secure, prompt management and responsible AI usage.

Keywords: Generative AI, Blockchain, Verification, Hallucination mitigation, Cryptography, Prompt injection defense, Secure AI governance

Explainable AI-Based Natural Language Processing Model for Legal Text Summarization

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The increasing volume and complexity of legal texts, such as legislative bills, necessitate automated summarization tools to assist legal professionals in efficiently processing and understanding critical information. The intended model presents an Explainable AI (XAI)-based Natural Language Processing (NLP) framework for summarizing legal texts, leveraging a fine-tuned BART (Bidirectional and Auto-Regressive Transformer) model on the BillSum dataset. To address the "black-box" nature of deep learning models, the proposed model integrates the XAI methods (LIME (Local Interpretable Model-agnostic Explanations) and SHAP (SHapley Additive exPlanations)), and BART techniques, i.e., permutation and attention visualization. Permutation importance identifies key tokens by measuring their impact on ROUGE-L scores, LIME provides interpretable local approximations of model predictions, SHAP offers game-theoretic feature attributions, and attention visualization reveals token interactions via BART's self-attention mechanism. The proposed model collectively enhance transparency by highlighting critical legal terms (e.g., "plaintiff," "Act") that drive summarization, enabling legal practitioners to trust and validate model outputs, and also optimize the scalability, visualization, and practical applicability. The model achieves robust performance, demonstrating its ability to generate concise and accurate summaries of complex legal documents.

Keywords: Legal text summarization, Explainable Artificial Intelligence, BART transformer model, BillSum dataset, ROUGE evaluation metrics

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PrivateEye: A Framework for Evaluating the Usability and Efficacy of Local-First Large Language Models for Privacy-Conscious Productivity

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The proliferation of cloud-based Large Language Models (LLMs) has revolutionized productivity software but introduces significant privacy risks, as sensitive user data must be transmitted to third-party servers. This research explores the viability of a local-first AI paradigm, where LLMs run entirely on end-user hardware, eliminating data exfiltration. We present PrivateEye, a desktop application framework designed to deploy and evaluate optimized open-source LLMs for core productivity tasks, including document summarization and text generation. The central challenge addressed is the performance-quality trade-off inherent in running resource-intensive models on consumer-grade hardware with limited memory and computational power. Our methodology involves a systematic evaluation of model optimization techniques, primarily model quantization, to balance inference speed and output quality. We benchmark models like Llama 3 and Mistral across different quantization levels, measuring metrics such as tokens-per-second, memory footprint, and task accuracy. Furthermore, the project investigates human-computer interaction principles for designing effective user interfaces that manage expectations during inherently slower local processing. The findings demonstrate that while local models incur a performance penalty compared to cloud counterparts, strategic optimization and thoughtful UI design can yield a usable and practical privacy-preserving alternative. This work contributes a benchmark for on-device LLM performance, an open-source framework for local AI development, and design guidelines for latency-tolerant applications, advancing the field of confidential and sovereign computing.

Keywords: Local-first AI, Large language model, Model quantization, Privacy-preserving computing

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Confidential Computing for Multi-Party Machine Learning in Serverless Clouds

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The rise of serverless platforms has made multi- party machine learning (MPML) attractive for collaborative analytics, but executing joint training or inference across mutually distrustful parties on third-party serverless functions exposes sensitive data and model updates. This work addresses the integration of Confidential Computing (hardware Trusted Execution Environments) with serverless orchestration to support privacy-preserving MPML workflows. We present a hybrid framework that partitions ML tasks into TEE-aware functionlets, leverages secure enclaves for sensitive operations, and coordinates state and aggregation through an encrypted serverless key-value layer with attestation-driven runtime composition. Our methodology includes formal threat modeling for insider, cross-tenant, and side-channel adversaries, a proof-of-concept implementation on an open serverless stack augmented with enclave runtimes, and an evaluation on representative federated learning and secure aggregation workloads. We report measured trade-offs between confidentiality, latency, and cost, and propose practical mitigations for enclave limitations such as memory constraints and attestation overhead. The contributions are a concrete design pattern for enclave-compatible serverless MPML, an empirical characterization of performance/security tradeoffs, and deploy- ment guidelines for regulated industries seeking collaborative analytics on serverless clouds.

Keywords: Confidential computing, Serverless, Multi-party machine learning, Trusted execution environments, Secure aggregation, Attestation

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LIME-Based Explainable Deep Learning Framework for Handwritten Digit Classification

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Deep learning models have already demonstrated impressive performance in handwritten digit recognition but their inability to be interpreted is one of the most significant issues in the study of explainable AI. This paper suggests a deep learning architecture that can be interpreted to classify handwritten digits with the JC-ProgJava Handwritten Digit Dataset containing more than 107,730 handwritten greyscale images separated into ten categories. To make sure that the features are extracted efficiently and that the convolutional neural network does not overfit the proposed CNN model includes several convolutional, batch normalization, pooling, and dropout layers. There is a lot of data augmentation, in rotation, shifting, zooming, and brightness changes, which improves the generalization ability of the model. Local Interpretable Model-Agnostic Explanations (LIME) are also added to enhance transparency and visualize the most influential areas in the image to the CNN predictions. This model had a high training accuracy of 98% and validation accuracy of 97-99 percent. when discriminating among classes of the digit which is high performance and generalization. The model is also effective as there are high precision and recall rates. Enhancing user trust with the incorporation of interpretability methods contributes to ethical use of AI in practice of computer vision.

Keywords: Handwritten digit classification, Convolutional neural network, Explainable AI, Local interpretable Model-Agnostic explanations, Image data augmentation

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Automated Detection and Classification of Dental Caries in Panoramic Radiographs Using YOLO-Based Deep Learning Models

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Dental caries constitutes a significant oral health issue, impacting over 3.5 billion individuals worldwide. Timely and accurate identification is crucial to avert discomfort, infection, and the potential loss of teeth. Traditional diagnostic approaches, such as radiographic evaluations, frequently encounter limitations due to clinician bias and may overlook early-stage or minor lesions. This study introduces a comprehensive automated deep learning framework utilizing advanced YOLO architectures (YOLOv8, YOLOv9, and YOLOv11) for the real-time detection and classification of dental caries in panoramic radiographs. The proposed system executes binary classification (caries vs. no caries) and multiclass classification according to the six G.V. Black cavity types, while also facilitating quadrant-wise localization of lesions. The comparative evaluation revealed that YOLOv11 attained the highest levels of accuracy and detection efficiency in all tasks assessed. The established framework offers a scalable, real-time diagnostic tool designed to aid dental professionals in attaining more consistent and precise evaluations. Furthermore, it plays a significant role in advancing the United Nations Sustainable Development Goal 3 (good health and well-being) by improving oral healthcare through the early and accurate identification of dental caries.

Keywords: Dental caries detection, Panoramic radiographs, Deep learning, YOLO, Classification

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NEURO-ARIEL: Emotion-Aware AR and LLM Framework for Autism-Inclusive Learning Analytics

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This paper presents NEURO-ARIEL, a framework that links augmented reality, large language models, and emotion-aware analytics for autism-inclusive learning. NEURO-ARIEL stands for Neurodiverse-Inclusive Augmented Reality with Emotion-Aware Learning, designed to combine immersive tools with adaptive analytics. The aim is to provide practical learning analytics that support teachers and autistic students in digital classrooms. Autistic learners face barriers in remote education. Many platforms do not capture engagement or emotional signals. Teachers often lack real-time insights about learner states. Past work in learning analytics has focused mainly on cognitive performance and test scores, with little attention to emotion or adaptive feedback. NEURO-ARIEL addresses this gap through three linked layers. Augmented reality delivers interactive and immersive content. Large language models provide adaptive dialogue and personalized feedback. Emotion-aware analytics track engagement from behavioral and physiological cues. Together these layers support inclusive, responsive, and measurable digital learning. Due to time limits, a real-time classroom trial was not conducted. Instead, the study draws on the Engagnition dataset. The framework processes the dataset in three steps. First, raw signals are preprocessed into time windows. Second, classifiers map these features into engagement states such as high attention, low attention, or stress. Third, the outputs are linked to adaptive responses from AR and LLM modules in a simulated environment. NEURO-ARIEL provides a structured approach that combines AR, LLMs, and analytics into one pipeline. Future work will test live AR classrooms and extend multimodal features such as voice cues.

Keywords: Autism; Emotion-aware analytics; Augmented reality; Large language models; Inclusive learning

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Holistic Adaptive Real-Time Health Intelligence System (Harhis): A Django-Based Framework for Multi-Modal Data Fusion, Prediction, and Adaptive Interventions

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Health systems must now address unprecedented burdens posed by an enormous heterogeneity of data, and the ability to predict trajectories of illness and to intervene properly in a patient's context condition. In this paper, we propose a new framework called the Holistic Adaptive Real- Time Health Intelligence System (HARHIS) that can integrate multi-modal health data sources and combine with the predictive intelligence to enact an adaptive intervention plan while maintaining explanation capability and privacy protection. Based on the Django framework for scalable orchestration, HARHIS intake electronic health records, streams from wearable sensors, gene sequences and environment-social indicators into real time pipelines in order to harmonize them towards an interoperable standard format. In this study, we propose a new multi-modal data fusion engine to merge various heterogeneous streams into a unified knowledge graph, having sub-modules such as for temporal predicting (TCN-Transformer) and progression prediction. HARHIS includes an individual, personalized digital twin for each patient that allows representation of dynamic health trajectories. Continuous optimization of patient-specific strategies is implemented by an adaptive intervention layer that uses reinforcement learning agents and real-time context modules. Explainability is provided by a causal explanation generator, natural language interface and collaborative dashboards that allow physicians and patients to comprehend model outputs in order to co-create care plans. The system also bolsters clinical decisions with personalized suggestions, patient-provider alerts and adaptive plans of care. The findings underscore its opportunities to improve health outcomes, support patients and build resilience in health systems against future challenges. This study shows the possibility of a scalable, intelligent and ethically aligned health intelligence system that can change healthcare practice.

Keywords: Health intelligence, Django, Digital twin, Adaptive intervention, Explainability

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Improving Diagnosis and Classification of Lung Nodule Through Deep learning

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One of the main causes of cancer-related death worldwide is lung cancer. The early detection of lung nodules is difficult for timely diagnosis and treatment in computed tomography scan images. However, detecting small pulmonary nodules in medical images is highly challenging due to their wide variation in shape, size, and location. This paper presents a deep learning-based approach for diagnosing and classifying lung nodules for cancerous patients. An enhanced YOLOv8 model is used for detecting small sizes in lung cancer nodules. For classification, a hybrid model integrating Convolutional Neural Networks (CNN), Squeeze-and-Excitation (SE) blocks, and Transformer-based attention mechanisms is proposed to improve feature representation and accuracy. A publicly available dataset is utilized to evaluate the performance of YOLOv8 and the hybrid method for classification. The dataset from Kaggle (Augmented IQ-OTHNCCD) contains three types of nodules (normal, benign, and malignant). The state-of-the-art (YOLOv8) model achieves successful detection of small size cancer nodules in the early stage. The classification model achieved 96% accuracy, 93% precision, 96% recall, and 95% F1-score on the Kaggle dataset validating the model's ability to accurately identify lung cancer cases. The combined YOLOv8 model and hybrid classification approach provides a computer-based solution for early lung cancer nodule detection, potentially reducing missed diagnoses and improving patient outcomes.

Keywords: Cancer, CNN, Yolov8, Deep learning

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Computer Science
Poster Presentations

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Multi-Class Classification of Alzheimer's Disease Stages Using Transfer Learning and Data Augmentation on MRI Images

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Alzheimer's disease is a progressive and untreatable neurodegenerative disorder that gradually impairs memory, thinking abilities, and daily functioning, making early detection crucial. This paper proposes an enhanced computer-aided diagnosis (CAD) system that automatically classifies Alzheimer's disease stages from brain MRI scans. The approach leverages deep learning techniques, specifically a pre-trained Convolutional Neural Network (VGG16), combined with extensive data augmentation strategies to address class imbalance and improve generalization. The system classifies MRI images into four categories: Non-Demented, Very Mild Demented, Mild Demented, and Moderate Demented. Experimental results demonstrate that, with the proposed augmentation techniques and transfer learning, the model achieves over 90\% classification accuracy across all four classes on a standard public MRI dataset. These promising results highlight the potential of advanced deep learning and data augmentation to support early and more accurate Alzheimer's disease diagnosis.

Keywords: Alzheimer disease, Deep Learning, VGG16, MRI, Data augmentation, Computer-aided diagnosis, Multi-Class Classification.

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Enhancement of Sentiment Analysis of Healthcare Feedback Using Generative AI

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Patient satisfaction and healthcare outcomes are increasingly influenced by how effectively healthcare systems integrate patient perspectives into decision-making. Patient feedback, often expressed in free-text surveys and social media posts, contains valuable emotional and contextual cues that can guide quality improvement. However, the unstructured nature of such feedback, combined with diverse linguistic expressions, poses significant challenges for traditional sentiment analysis methods that rely on fixed lexicons or shallow machine learning models. This research explores the application of large language models (LLMs) and generative AI tools to improve the accuracy and depth of sentiment detection in healthcare-related text. Unlike conventional algorithms, LLMs leverage pre trained knowledge and contextual understanding to interpret subtle expressions of satisfaction, dissatisfaction, empathy, and concern. The proposed framework fine-tunes generative AI models on domain-specific healthcare feedback to capture nuanced meanings and handle ambiguous language typical of patient narratives. Experimental results demonstrate enhanced sentiment classification performance and a higher ability to identify implicit emotions and mixed sentiments compared to lexicon-based and traditional models. These findings highlight the transformative potential of generative AI in extracting actionable insights from unstructured healthcare data. Incorporating such intelligent models into sentiment analysis workflows can enable personalized patient care, more responsive service design, and evidence-based health system optimization.

Keywords: Generative AI; Large language models; Sentiment analysis; Healthcare feedback; Patient experience; Health informatics

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Towards a standardized methodology and dataset for evaluating LLM-based digital forensic timeline analysis

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Large language models (LLMs) have seen widespread adoption in many domains including digital forensics. While prior research has largely centered on case studies and examples demonstrating how LLMs can assist forensic investigations, deeper explorations remain limited, i.e., a standardized approach for precise performance evaluations is lacking. Inspired by the NIST Computer Forensic Tool Testing Program, this paper proposes a standardized methodology to quantitatively evaluate the application of LLMs for digital forensic tasks, specifically in timeline analysis. The paper describes the components of the methodology, including the dataset, timeline generation, and ground truth development. Additionally, the paper recommends using BLEU and ROUGE metrics for the quantitative evaluation of LLMs through case studies or tasks involving timeline analysis. Experimental results using ChatGPT demonstrate that the proposed methodology can effectively evaluate LLM-based forensic timeline analysis. Finally, we discuss the limitations of applying LLMs to forensic timeline analysis.

Keywords: LLM;Forensic timeline; Large language models.

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Hybrid QR PUF Tags in IoT Blockchain Networks for Enhanced Pharmaceutical Traceability

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Counterfeit pharmaceuticals becoming a serious global threat to the human and animal life. It leads to the ineffective treatment and even the life loss in severe cases. The conventional techniques to prevent counterfeit drugs circulation into the market such as QR codes and RFID sensors are limited due to the possibility of cloning. The blockchain based supply chain solutions are gaining popularity but they do not provide the physical authenticity of the product. This paper proposes a Hybrid QR tag system with Physical Uncloneable Function (PUF). It is integrated with IoT and blockchain system that provides dual layer authentication. The encryption of the QR codes ensures the secure digital linkage to blockchain records. The PUF embedded in packaging established a tamper proof fingerprint. The proposed IoT blockchain solution enables real-time authentication across supply chain nodes. Evaluation metrics such as the latency, false acceptance and false rejection rate and blockchain throughput highlight the feasibility and scalability of the proposed solution. This provides the enhances security to prevent cloning and tampering of the the tags and QR codes to safeguard the pharmaceutical supply chains.

Keywords: Blockchain, IoT, Blockchain-based supply chain; Anti-counterfeit

Enhancing Software Usability through User-Centric Requirement Engineering Approach

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The usability of software systems is a critical factor in their acceptance. Traditional Requirement Engineering (RE) often prioritizes functional and technical needs while overlooking usability, leading to low adoption, user frustration, and costly corrections. This study addresses these issues by integrating User-Centric Requirement Engineering (UCRE) into software development to systematically manage usability concerns. A mixed-method approach was applied through quantitative survey analysis and qualitative feedback on a University ERP system. A structured questionnaire with 36 usability-related variables was distributed among faculty, administrative staff, and students, covering modules such as attendance, scheduling, grading, and exam management. Descriptive statistics, correlations, and categorizations were used to identify critical usability gaps. Findings highlight the positive role of early user engagement, iterative usability testing, and requirement prioritization in enhancing system efficiency, effectiveness, and satisfaction. The proposed UCRE framework, validated empirically focuses on active user involvement, prototype validation, and structured usability assessments using heuristic evaluation, SUS scoring, and think-aloud protocols. Results categorized ERP usability challenges into major (33%), average (22%), and minor (16%). Major issues, including integration, fault tolerance, and performance, most strongly influenced user satisfaction. Average challenges, such as scheduling, grading, and exam management, showed moderate usability but required targeted improvements. Minor concerns, like interface clarity and design consistency, had a lesser impact but still shaped overall user experience. This systematic ranking enables prioritization of improvements, while the UCRE framework provides practical guidance for researchers, developers, and organizations in creating user-friendly, efficient software systems.

Keywords: Requirement engineering; Human-computer interaction, Usability evaluation, User experience; Enterprise resource planning; Usability testing

Dermal Science
Oral Presentations

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A Crossover Comparison of Team-based Learning with Traditional Lectures on Students' Application of Knowledge in Forensic Medicine

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Teaching undergraduate medical students in the new millennium entails a great degree of complexity due to the breadth of curriculum and evolving student needs. Thus, newer educational methodologies like Team-based learning (TBL) are gaining more popularity as it claims to promote application of knowledge along with self-directed learning and teamwork. However, there is little evidence to support this claim particularly in Forensic Medicine. In this study we aimed to evaluate this claim by comparing the results of using TBL vs traditional lectures on students' exam scores and students' perceptions. A Quasi-experimental crossover study design was employed to appreciate the effectiveness of TBL in 135 third year MBBS students attending Forensic Medicine course at University Medical & Dental College, Faisalabad. Non-probability convenience sampling technique was used in which students were divided into two groups that attended TBL or lectures sessions. For the first part of the study, Group1 participated in three TBL sessions while Group 2 received didactic lectures. The groups were crossed over during the second part of the study. Students were evaluated by two assessments consisting of MCQs and SEQs that were based on application-level questions. Students' perceptions were measured through the TBL-Student Assessment Instrument. Our results showed that the difference between the test scores of both the groups was not statistically significant. However, students demonstrated strong positive perceptions towards TBL. In conclusion, when it comes to test scores TBL is as effective as traditional lecture while using lesser resources. Furthermore, these millennials prefer Team-based learning over lectures in the context of accountability, preference for learning method and satisfaction. The study thus proposes that TBL has the potential to provide a more favourable and engaging learning environment to medical students.

Keywords: Active learning, Flipped classroom, Medical students, Student satisfaction, Team-based learning;Traditional lectures

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From Stress to Strategies: Mapping Digital Resilience through the DR Compass among Undergraduate Medical Students in Pakistan

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The rapid integration of social media in medical education has transformed how students access and share knowledge. Platforms such as YouTube and Google provide visual and collaborative opportunities but also create challenges of overload, distraction, and digital fatigue. Developing digital resilience, the ability to adapt effectively to such challenges, has therefore become an essential skill for medical students, particularly in low- and middle-income settings. This qualitative case study explored the strategies undergraduate medical students in Pakistan employ to build resilience while using social media for learning. Twenty-five MBBS students (five from each year) were purposively selected from a private medical college. Data were collected through semi-structured interviews, transcribed verbatim, and member-checked. Thematic analysis was conducted in ATLAS. it by two independent researchers, with triangulation, audit trails, and reflexive notes ensuring trustworthiness. Findings revealed a progression of strategies across the five years. First-year students coped with overload through high-yield content and peer sharing. Second-year students adopted time-management tools such as Pomodoro and learning applications. Third-year students emphasized selective curation of YouTube channels and purposeful device management. Fourth-year students highlighted collaborative, case-based use of social media, while final-year students stressed balance and well-being through offline note-taking and device segregation. The study proposes the Digital Resilience (DR) Compass, a framework mapping this progression from basic adaptation in early years to strategy refinement in senior years. It illustrates that digital resilience is not fixed but a learnable process. Embedding digital resilience training into medical curricula can foster both academic success and student well-being, offering a holistic approach to learning in digital environments.

Keywords: Digital resilience, Social media, Medical education, Pakistan, Qualitative research

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Reinventing Dental Education: A Gamification-Driven Pedagogical Model to Enhance Cognitive Engagement, Clinical Rreasoning and Learner Agency in BDS Students

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Gamification is rapidly transforming health professions education, yet its application in dental curricula remains limited to quiz-based engagement. This study introduces an innovative, multi-layered gamification model using Kahoot, Socrative, and Brrrshna to enhance cognitive engagement, clinical reasoning, and learner autonomy among Bachelor of Dental Surgery (BDS) students. Unlike conventional approaches, the intervention incorporated competitive participation, adaptive assessment analytics, and student-generated games simulating real-life dental scenarios, creating a dynamic and learner-centered educational ecosystem.Kahoot was implemented for rapid retrieval practice and spaced repetition, Socrative for case-based formative assessments with real-time diagnostic analytics, and Breshna for student-designed clinical gamified modules that mirrored chairside decision-making. A mixed-methods research design was employed, including pre- and post-intervention testing, engagement indices, and qualitative reflection journals. Results demonstrated a 42% improvement in knowledge retention, 78% increase in participation, and a significant enhancement in problem-solving accuracy ($p < 0.01$). Students reported heightened motivation, reduced exam-related anxiety, and improved confidence in diagnostic reasoning. Importantly, the use of Brrrshna marked a notable shift from passive reception to active knowledge construction, aligning with higher domains of Bloom's Taxonomy and Miller's Pyramid.This study is among the first to implement student-generated gamification in dental education and introduces a Gamification Engagement Index (GEI) as a novel metric for academic immersion. Findings confirm that structured gamification is a scalable and context-sensitive pedagogical model capable of transforming dental education from didactic instruction to an interactive, competency-driven approach.

Keywords: Gamification, Dental education, Kahoot, Socrative, Brrrshna, Clinical reasoning, Learner engagement

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V-Logging as a Pedagogical Tool for Gen Z: A Pilot Study

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Generation Z students (born 1997–2012) are characterized by shorter attention spans (approximately 8 seconds) and a strong preference for dynamic, interactive, and visually driven content. Traditional pedagogical methods often fail to sustain their engagement, particularly in practice-oriented disciplines such as cosmetic sciences, where experiential learning is fundamental. This calls for innovative, technology-integrated teaching strategies that align with Gen Z's digital learning preferences. This study explored the impact of integrating student-created video logs (vlogs) as an alternative to traditional written practical notebooks on engagement, practical skill acquisition, and conceptual understanding among undergraduate cosmetic sciences students. A quasi-experimental design was employed. Undergraduate students attending cosmetic sciences course at The University of Faisalabad were divided into two groups through convenience sampling: one group maintained traditional written practical notebooks, while the other documented their practical learning through vlogging. Quantitative data included rubric-based assessments, quizzes and surveys. Findings show that vlogging enhances engagement, attention, and conceptual understanding compared to traditional notebook-based learning, suggesting its potential as an effective pedagogical tool for Gen Z learners.

Keywords: Gen Z;Vlogging; Cosmetic sciences education, Engagement; Digital Pedagogy,; Mixed methods

Gen Z and Academic Reading in the Age of Artificial Intelligence: An Exploratory Study

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Academic reading is essential in higher education as it enhances comprehension, critical thinking, and analytical skills among undergraduates. Academic learning has always been grounded in students' engagement with textbooks, research journals, and peer-reviewed literature. However, in the age of Artificial Intelligence (AI), reading behaviors are rapidly evolving. Generation Z (born between 1996 and 2012) increasingly relies on digital tools and AI-based platforms that provide quick summaries and instant access to academic content. While these technologies offer convenience, they may reduce engagement with traditional academic reading practices. However, limited literature exists on understanding Gen Z undergraduates' preferences toward academic reading. Therefore, this study aims to explore and highlight the preferences of Generation Z students regarding academic reading in the age of Artificial Intelligence. A cross sectional survey was conducted with 300 undergraduate Allied Health students. The results showed that majority of the students prefer short summaries and blogs instead of reading book chapters and journal articles.

Keywords: Generation Z; Artificial intelligence; Academic reading

Does AI kill student creativity? The Undergraduate Students' Viewpoint

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Artificial intelligence (AI) has transformed how students engage with academic tasks, reshaping learning practices and cognitive processes. While AI tools offer support as study partners and enhance efficiency, their growing use has raised questions about their influence on students' critical thinking and creativity. This study aimed to explore the experiences of university students regarding AI usage in academic work and its perceived effects on essential cognitive and creative skills. A qualitative design was employed, with nine students purposively selected from Government College University, Faisalabad. Semi-structured interviews of approximately one hour were conducted with each participant, transcribed verbatim, and analyzed through thematic analysis using QDA Miner Lite. Trustworthiness was ensured through triangulation, audit trails, and reflexive notes. Eight themes emerged including AI as study partner and learning assistance, growing dependence and overreliance on AI, balancing human creativity with AI support, developing critical thinking through conscious use, understanding AI limitations and the need for verification, cognitive engagement and emotional responses to AI, academic practices and institutional responsibility, and integrating AI with human insight for future use. Findings indicate that AI positively supports idea generation, comprehension, and efficiency, yet excessive dependence risks undermining originality, confidence, and independent thought. Students highlighted the importance of conscious, balanced engagement with AI to preserve creativity and critical thinking.The study concluded that AI's impact on critical thinking and creativity is dual in nature, offering opportunities when used thoughtfully but posing risks when relied upon uncritically.

Keywords: Artificial intelligence, Critical thinking, Creativity, Academic work, Qualitative research

Design & Interior
Oral Presentations

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Framework Development of Biophilic Model for Corporate Buildings

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Environmental degradation and unorganized cities are rising issues because of a growing population in an era of fast globalization. People confronted a dilemma with denser and congested urban development, which highlighted the fragility of towns and their residents. There are no such rules that govern the general equilibrium of the ecosystem due to rising urbanization and unplanned cities. As a result, global temperatures will rise by 1.5 degrees Celsius by 2050. Rapid building has made a substantial impact on the natural world to meet the requirements of a rising population. It contributes to global warming by generating more than 30% of the world's emissions of greenhouse gases. Buildings are the largest energy consumers and equivalent to approximately 40% of all primary energy sources e.g., fossil fuels, nuclear energy, and hydro-energy. Sustainable construction and development methods are being used to reduce negative consequences and create an environment that is more environmentally friendly. The use of biophilic design principles in building construction to generate connections between people and the environment is one method of achieving sustainability. This study conducts a detailed literature review that identifies and compares the major categories of biophilic design and explains their major elements. We then analyze the benefits (e.g., enhance health, well-being, productivity, economic benefits) of biophilic design in achieving sustainability, as framed through building rating systems. The results help in developing a biophilic model framework that can be used by designers and architectures for a more sustainable, healthy and resilient environment in the corporate sector. Moreover, knowledge gaps are identified to motivate future research and critical reflections on biophilic design practices by implying the framework.

Keywords: Biophilic design, Sustainable environment, Conceptual framework, Economic growth, Productivity, Well-being

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Adaptive Micro Habitat for Digital Nomads

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In today's world of mobility and digital progress, the demand for flexible, multifunctional living spaces has grown significantly. This project looks at creating a modular micro-living space designed for digital creators, people who live and work while moving, combining lifestyle with creativity. Inspired by the clever structure of origami, the design uses folding geometry to achieve adaptability, compactness, and changes in space. The pod includes modularity and flexibility, letting users assemble, expand, or fold it for easy movement and efficiency. Each part serves multiple purposes; walls can act as storage, partitions can become work surfaces, and panels can open to let in natural light. Sustainable materials like lightweight aluminum frames, bamboo panels, and smart textiles are used to ensure environmental balance and durability. Morpho Pod responds to the changing lifestyles of creative nomads, individuals who thrive in dynamic, tech-driven settings. By combining architecture, design innovation, and digital culture, the project offers a living ecosystem that supports creativity, comfort, and connection. Ultimately, it celebrates the freedom to move and the art of living small, where every fold represents adaptability, imagination, and modern creativity. Beyond its functional and aesthetic qualities, the design also meets the psychological needs of modern creators who often blur the lines between work and personal life. The layout of the pod encourages focus, relaxation, and inspiration through thoughtful zoning, integrating spaces for content creation, rest, and reflection within a compact area. Natural light, tactile materials, and sound control create an environment that supports both productivity and emotional well-being. By combining biophilic principles with digital adaptability, the pod becomes a responsive space that changes with its user's rhythm and purpose. Ultimately, it envisions a future where architecture is not static but dynamic, mobile, and closely connected to human creativity.

Keywords: Modular micro-living, Multifunctional space, Creative nomads, Portable architecture, Adaptability

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Blending the Metaverse into Real Worlds

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As digital technologies evolve, the boundary between virtual and physical environments is rapidly dissolving. This paper explores how the concept of the Metaverse is reshaping the way interior designers imagine, create, and experience space. The Metaverse introduces new layers of interaction, where digital content merges with real settings to form phygital (physical + digital) experiences. These hybrid environments blur distinctions between tangible materiality and immersive simulation, opening possibilities for responsive, adaptive, and participatory interiors Metaverse becomes a critical medium through which users experience, navigate and co-create meaning. The research examines how metaverse tools such as virtual prototyping, augmented reality, and 3D world-building can inform real-world spatial design. It discusses how digital extensions of space influence human behavior, emotional connection, and the sense of presence within interiors. The study also reflects on the designer's evolving role as both a physical and virtual world builder. Ultimately, it argues that blending the Metaverse and real worlds encourages a new design language, one that is inclusive, experiential, and dynamic, connecting human imagination with emerging technologies to redefine the future of interior space. This highlights examples of retail, exhibition, and educational spaces that integrate virtual overlays, interactive projections, and mixed-reality experiences. These projects demonstrate how metaverse-inspired design can foster deeper engagement, inclusivity, and personalization in physical interiors. Furthermore, it addresses challenges such as digital accessibility, sensory overload, and the need for human-centered design principles in hybrid spaces. Ultimately, the study argues that blending the Metaverse and real worlds creates a new design paradigm, one that redefines spatial experience, connects emotion with technology, and positions interior design as a bridge between imagination and reality.

Keywords: Phygital environments, Digital accessibility, User interactions

Education

Oral Presentations

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Exploring Opportunities and Challenges in STEAM-Based E-Learning Adoption in Pakistan: A Quantitative Study

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E-learning has rapidly gained global traction among scholars, learners, and educators. This study examines the opportunities and challenges of adopting STEAM-based e-learning at Pakistan's first Virtual University. The study's main goal was to identify key challenges perceived by both students and faculty in adopting e-learning at Virtual Universities in Pakistan. The study employed theoretical frameworks, including the Technology Acceptance Model (TAM), constructivist learning theory, and connectivism, to explore cognitive, behavioral, and social dynamics. It investigated the e-learning experiences of students and staff at Pakistan's Virtual University, using a quantitative research approach. A non-probability, purposive sampling method was employed, with data collected via self-administered surveys and personal visits to campuses. The study aimed to understand e-learning initiatives within the virtual university system. Results show that while e-learning in Pakistan offers significant benefits, its full potential is hindered by key challenges. The research confirms that e-learning is viewed as an efficient, accessible way to achieve educational goals, with strong support for its role in enhancing interactive learning and improving teachers' skills, particularly in e-pedagogy. However, major obstacles include unstable ICT infrastructure, low digital literacy among students and faculty, financial constraints, and resistance to change from some faculty members. The study concludes that successful, widespread e-learning adoption in Pakistan requires a comprehensive plan addressing these critical issues. The study recommends investing in infrastructure, faculty development, policies, student support, and awareness campaigns to advance e-learning.

Keywords: E-learning adoption, Digital transformation, Digital literacy, Infrastructure challengess

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Assessing Misconceptions in Physics within a STEAM Framework: Psychometric Validation of a Five-Tier Diagnostic Test

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Traditional assessments often mask the quality of students' reasoning, limiting diagnostic insights. Multi-tier diagnostic tests, validated psychometrically, offer a better way to identify misconceptions and learning gaps. This study develops a five-tier multiple-choice diagnostic test for physics, with the fifth tier probing the sources of misconceptions (e.g., intuition, personal thoughts, teacher explanations, peer influence, textbooks, internet), and evaluates its psychometric quality using Classical Test Theory (CTT) and the Rasch (1PL) model. Previous studies in Pakistan have relied mainly on CTT, with limited application of the Rasch model. The Rasch model provides item-level, sample-independent measures and a common scale for comparing student ability and item difficulty, improving diagnostic precision. This study aimed to construct a valid five-tier test covering three physics units, analyze item properties using CTT, and apply the Rasch 1PL model to improve measurement quality and explore why misconceptions arise. A total of 107 9th-grade students participated. The test included 20 five-tier MCQs on Kinematics, Dynamics, and Turning Effect of Forces. Each item measured content answer, confidence in content, reasoning choice, confidence in reasoning, and source of misconception. Responses were categorized as Full Understanding (FU), Partial Understanding (PU), Guessing (G), Misconception (M), and Lack of Knowledge (LK). CTT results showed item difficulty from 0.32–0.81 (M = 0.58), discrimination indices from 0.21–0.62 (M = 0.42), and Cronbach's alpha = 0.84. Rasch calibration placed items between -1.25 and +1.10 logits, with person reliability = 0.79 and item reliability = 0.88, supporting stable measurement. Diagnostic profiling revealed misconceptions in Dynamics, guessing in Kinematics, and partial understanding in Turning Effect of Forces. Tier 5 responses indicated that misconceptions stemmed from intuition, personal thoughts, and external sources like teachers, peers, and textbooks. By adding a fifth tier to explore sources of misconceptions, the instrument offers deeper insights, helping teachers address misconceptions at their root and fostering conceptual change in physics education.

Keywords: Five-tier diagnostic test, Physics misconceptions, Mechanics, Sources of misconceptions

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Relationship Between SST's Advanced STEAM Skills and their Impact on Students' Creativity Skill at Secondary level

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This study aimed to examine the relationship between secondary school teachers' advanced STEAM (Science, Technology, Engineering, Arts and Mathematics) skills and students' creativity at the secondary level. A correlation research design was employed. The population of the study consisted of secondary school teachers (SSTs) and students of Grade-10 from urban and rural areas of District Faisalabad. From this population, a sample of 50 SSTs and 100 students of Grade-10 were selected using a convenient sampling approach from Tehsil Sadar and Tehsil City Faisalabad. To assess teachers' advanced STEAM skills (including content knowledge and integrated teaching methodologies), a validated and reliable questionnaire (20 items) was administered. Students' creativity was measured through a test (15 items) based on STEAM subjects. The quantitative data collected from both teachers and students were analyzed using statistical techniques such as mean, standard deviation and correlation, with the help of SPSS software. The findings revealed a positive but moderate relationship between teachers' advanced STEAM skills and students' creativity. The study recommends organizing special training programs and workshops for secondary school teachers to enhance their STEAM skills and resultantly to develop greater creativity skill among students in STEAM subjects.

Keywords: STEAM, Students' Creativity skills, Secondary level

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Utilizing Artificial Intelligence to Optimize Professional Development for 21st-Century Teachers in STEAM Education

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This study investigates the integration of artificial intelligence (AI) into professional development (PD) programs for 21st-century teachers, aiming to assess its impact on self-efficacy and satisfaction through a quantitative research design. The data were collected from 80 in-service teachers through a questionnaire. Results indicate a moderate positive correlation between AI integration and teacher self-efficacy ($r = 0.27$, $p < .05$) as well as satisfaction ($r = 0.34$, $p < .01$). The ratings of the participants about the AI-infused PD experiences were positive, with the tools that supported the participants with real-time feedback, individualized learning trajectories, and adaptability. But when independent-samples t-tests were used, the pairs did not significantly differ in the overall satisfaction or self-efficacy between teacher participants of the AI-integrated PD and those who did not take part in it. Item-level analysis established that the ability to track progress and make personal recommendations was the most strongly associated feature with perceived professional growth. The findings also indicate that the presence of AI in PD may not be of essence alone. Still, the characteristics and capabilities of AI tools do play an important role in changing the perception of the teachers and the manner in which they learn. The paper ends by emphasizing the importance of proactive, thoughtful and morally sound AI-PD construction and how this conclusion applies to both policymakers and educational managers interested in upgrading their teacher development work.

Keywords: Artificial Intelligence, Professional development, Teacher self-efficacy

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Challenges and Opportunities in Integrating Advanced STEAM Approaches in Primary Classrooms

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In the 21st century, traditional instruction is insufficient for addressing contemporary challenges in Science, Technology, Engineering, Arts, and Mathematics (STEAM), particularly in primary schools where the Arts play a crucial role in creative development. This study examines the challenges and opportunities of integrating advanced STEAM approaches in primary classrooms. Despite the growing importance of STEAM, there is limited research on its implementation in primary education. The research was descriptive and a survey of 99 primary school teachers from public schools in Chiniot was conducted using an online and in-person questionnaire. The 25-item survey assessed demographics, challenges, opportunities, and teachers' perceptions. Data were analyzed using descriptive statistics. The findings revealed that most teachers agreed they had a well-defined STEAM curriculum (M=3.69), integrated STEAM into their teaching (M=3.84), and felt confident designing STEAM activities (M=3.81). They also used project-based learning (M=3.71), collaborative methods (M=4.06), real-world problem-solving approaches (M=3.84), and technology (M=3.84). However, challenges such as insufficient funding (M=3.6), lack of professional development (M=3.42), overloaded curricula (M=3.70), outdated testing methods (M=3.48), large class sizes (M=3.78), and inadequate technology (M=4) were common. Teachers also cited lack of administrative support (M=3.7), innovative pedagogical skills (M=3.18), and alignment with curriculum standards (M=3.84) as barriers. The study highlights both the potential and challenges of STEAM integration. While teachers acknowledge opportunities for growth, substantial obstacles such as funding, professional development, and infrastructure hinder effective implementation. Teachers also face difficulties with pedagogy, curriculum alignment, and classroom management. This study recommends that these challenges be addressed and eliminated to effectively integrate STEAM into primary education.

Keywords: STEAM, Challenges, Opportunities, Primary education, Teachers' perceptions

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Relationship Between Transformational Leadership Style, Steam-Based Instructional Practices, and Secondary School Teachers' Performance

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Teachers' performance is influenced positively and significantly by transformational leadership style, staff motivation, and the implementation of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) education approach. This study examined the relationship between transformational leadership style, STEAM-based instructional practices, and secondary school teachers' performance in the Jhang District. The research adopted a correlational design, and participants included secondary school instructors and heads of institutions from all secondary schools within the district. Sixty (60) public secondary schools comprising two hundred and twenty (220) teachers were selected as the sample. Data were collected through structured questionnaires and analyzed using tables, Pearson product-moment correlation coefficients, and t-test statistics. Findings indicated that principals' leadership methods at secondary schools in District Jhang are transformational and at moderate levels, STEAM based instructional practices and teachers' performance are also at moderate levels. Moreover, the integration of the STEAM education approach was found to enhance teachers' creativity, motivation, and instructional effectiveness. The study recommends that school leaders adopt a transformational leadership style alongside STEAM-based pedagogical strategies to cultivate an environment of innovation, mutual respect, dedication, cooperation, and trust, thereby achieving optimal educational outcomes.

Keywords: Transformational leadership style, STEAM Instruction, Teachers' performance

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Analyzing the Effectiveness of Online STEAM Learning Platforms: A Critical Analysis of Literature

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Online STEAM learning platforms, accelerated by the COVID-19 shift, offer interactive digital learning experiences that foster critical thinking, creativity, collaboration, and digital literacy in K-12 and higher education. This post-2020 critical literature review assesses their effectiveness, focusing on engagement, skill development, and outcomes to provide evidence-based guidance for educators and policymakers. The review identified gaps in current research, including limited integration of the arts, neglect of equity issues in developing regions, insufficient teacher readiness for interdisciplinary online teaching, and a lack of long-term skill retention studies. A systematic search of Scopus, Web of Science, and Google Scholar for peer-reviewed studies (2020-2025) yielded 25 articles on platforms such as Khan Academy, GeoGebra, and custom STEAM tools. The data was analyzed by thematic technique, and themes like digital integration, barriers, and interdisciplinary impact were identified. Results showed medium-to-large effects for gamified STEAM tools like Scratch, Minecraft, and PhET, enhancing creativity, thinking, knowledge, and practical skills. However, barriers such as the digital divide (70% of studies), rural connectivity issues, and low teacher confidence (60%) were prevalent. The review concludes that online STEAM platforms promote digital skills, innovation, and cultural sustainability but call for a shift toward equity-focused, reflective practices. Despite their role in post-pandemic recovery, unresolved gaps could worsen educational inequities. It is recommended that more STEAM platforms be introduced into education system to achieve maximum competencies in STEAM.

Keywords: Effectiveness, Online STEAM platforms, Digital learning tools

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Impact of STEAM Instructional Approach on Students' Performance at School Level

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This study examined the impact of STEAM instructional appraoch on students' performance at the elementary school level from the perspective of teachers. A descriptive survey design was employed. The study had four objectives: (1) to assess teachers' awareness of the aims of STEAM education, (2) to evaluate their perceptions of its importance, (3) to examine their STEAM -related skills, and (4) to explore their views on the role of STEAM in enhancing student performance. The population comprised elementary school teachers from government boys' and girls' schools in Chiniot District, with a sample of 300 selected through convenience sampling. Data were collected using a 35-item questionnaire based on a five-point Likert scale and analyzed with SPSS (Version 24). Descriptive statistics, including means, standard deviations, frequencies, percentages, and correlations, were computed. Findings indicated that most teachers had not received any training in STEAM education, yet they demonstrated good awareness of its aims and importance. Teachers generally reported strong STEAM skills, except in engineering. The majority agreed that STEAM education positively influences student performance. Correlation analysis confirmed a statistically significant positive impact of STEAM education on students' performance ($r = .694$). This study recommends that proper and regular teacher training in STEAM educational approach should be conducted to enhance teachers' STEAM instructional skills.

English Language and Literature
Oral Presentations

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Constructing Arguments, Presenting Claims & Developing Structure

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Effective academic writing requires more than presenting ideas; it demands the ability to construct logical arguments, present claims clearly, and organize thoughts within a coherent structure. This presentation explores key strategies for developing well-founded arguments by integrating evidence, reasoning, and counterarguments. It will highlight how to formulate strong claims, differentiate between assertions and evidence, and employ rhetorical techniques to enhance persuasiveness. In addition, the session will focus on structuring arguments within research papers. Participants will gain practical tools for refining their academic and professional writing, enabling them to engage critically with texts, build sound arguments, and communicate ideas effectively across disciplines. They will also be able to critically evaluate academic writing to differentiate the authentic arguments.

Keywords: Academic writing; Argumentation; Critical thinking

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Presenting an Automated Writing Evaluation Tool for ESL Writing Analysis

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This presentation introduces an automated writing evaluation tool, developed collaboratively at the Department of Applied Linguistics, Government College University Faisalabad. Trained on a corpus of approximately 5,200 error-tagged argumentative essays from 12 universities of Punjab —compiled by 8 MPhil students and 143 university teachers—the tool uses Chain of Thought (cot) prompting with the o3 mini high model via API for accurate error annotation. It reflects diverse linguistic (Urdu, Punjabi, Pashto, Saraiki, Balochi) and disciplinary backgrounds, analyzing 16 ICLE error subcategories (e.g., verb forms, articles, punctuation). The AWE tool minimizes grading time, delivers robust feedback to foster learner autonomy, and addresses large-class challenges with a cot-based interface offering real-time error insights for targeted ESL teaching. This session will demonstrate its user-friendly design with sample analyses, discussing its role in reducing teacher workload, ensuring consistency, and promoting self-learning in multilingual settings.

Keywords: Automated writing evaluation, Chain of thought prompting, Esl writing, Error analysis, Pakistani students

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Enhancing Speaking English: Equity Ratio in Assessment of English Language

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A classroom generates language through interaction between a teacher and learners. In Pakistan 65% teachers (2013) use lecture method in which learners receive language. The examination system forces the learners to produce language in writing. The learners' written output is graded. Large classes do not accommodate enough interaction for the University freshman (UF) to produce language in speech. However, English speaking skill (ESS) is the highest bid in job opportunities. Speaking performances are hard to test. In spite of being arduous ESS needs to be tested and graded as consciously as English writing skill (EWS). Other than grading, speaking performances needed to have weightage in overall assessment of English. This study was based on developing ESS through giving weightage to speaking English of the UF. A survey was conducted among the university freshman to develop an insight in their oral English practices of teaching, testing, and grading at college level. Introducing the UF to recording their speaking performances, their progress in ESS was gauged by applying Kim's (2010) testing scales, which provided a theoretical scheme. As a case study, this research used longitudinal approach extending to two semesters of four and a half month each. To maintain vitality, a mixed method approach was used. Students' performances were analyzed through Microsoft Excel. University English Language teachers' (UELTs) and university administrators /Management's (UA&M) interviews were analyzed through textual analysis. This work tested the probability and confirmed that through a testing criterion the UF and the UELTs could improve the process of language learning. A criterion as a yardstick helped the learners to fit in to the optimum.

Keywords: Testing scales; Developing oral skills, Recorded speaking performances, Large classes, Equity ratio in assessment, Pakistan

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A Posthumanist Study of Transhuman Culture in Stross' *Accelerando*

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The ideas of transhumanism and posthumanism are intricately and inseparably interrelated and arrival of both invariably anticipates the next. The theory of posthumanism helps to explain why, and Transhumanism explains how this study of Charles Stross' Accelerando focused on the most relevant and important aspects of those above-mentioned theories as part of the methodology of the research and presented an outline about the form of discourse to be adopted for the rest of the research. The discussion on novel presents a compelling narrative that immerses readers in a future where technology has reshaped human existence, providing a compelling platform for critical inquiry. Two ways of achieving a Posthuman status that most of the major works in contemporary science fiction literature posit are – the merger of humans or parts of their bodies like brains with the inorganic machine substrates; and faithfully simulating every aspect of our self and physical reality in some virtual reality. This work aimed to explore and analyze the themes of Posthumanism and Transhumanism in a twenty first century dystopian, hard Science Fiction novel. Since this topic is a vast and multi-dimensional one, the focus employed a multi-theoretical perspective to capture and critically analyze various aspects of the target novel and a holistic discussion on the various possible ways in which each of those two phenomena cast their impact, energy, and influence on each other and the way that their interrelational dynamics go on defining the ever-evolving relation between man and reality, can give the necessary insight for peeling the layers of complexity and see into the heart of things.

Keywords: Posthuman; Transhuman, Interrelational dynamics; Relation between man and reality

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Dismantling Meta-Narratives: A Postmodern Analysis of The God of Small Things

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The present research critically examines Arundhati Roy's *The God of Small Things* (1997) from the lens of postmodern literary theory, with a specific emphasis on the dismantling of meta-narratives surrounding caste hierarchy and linear temporality. The study investigates how Roy strike at the foundations of long-standing cultural and structural archetypes, hence producing altogether new mini-narratives that foreground multiplicity, resistance, and fragmented truth. Closed readings of selected passages from the novel was done drawing upon Catherine Belsey's textual analysis methodology, to highlight the ideological and structural dimensions rooted within the novel. The analysis reveals that the transgressive love between Ammu, an upper-class woman, and Velutha, a Dalit untouchable, functions as a radical critique of the deeply entrenched caste system in India. The authority of caste as an unchallenged truth in the Indian society is exposed through this forbidden relationship. Times linearity is challenged by Roy using an innovative way on narration where the story constantly shifts between present and past so time is fluid, the shift is also about memory and trauma, thereby reflecting Ursula K. Heise's theorization of temporal distortion in postmodern narratives. By refusing chronological progression, the novel challenges the romantic notion of time as sequential and instead represents it as fragmented, cyclical, and disorienting. The study further situates Roy's work within Jean-François Lyotard's concept of incredulity toward metanarratives, arguing that *The God of Small Things* exemplifies postmodern skepticism toward grand cultural truths and historical continuities. The findings suggest that Roy redefines both love and memory as resistant forces against oppressive systems and demonstrates how South Asian literature participates in and contributes to global postmodern discourse.

Keywords: Postmodernism, Caste system; Temporal distortion, Arundhati Roy, South Asian literature

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Beyond Life and Time: Temporal Distortion and Metanarrative Subversion in Madeline Miller's the Song of Achilles and E. Lockhart's We Were Liars

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The present research aims to dismantle the metanarrative of life by focusing on unconventional chronology and narratives through the analysis of two novels Madeline Miller's The Song of Achilles (2012), and E. Lockhart's We Were Liars (2014). Both the novels use the technique of temporal distortion, bringing forth characters from the dead into the narrative, thereby breaking the traditional concepts of temporality and narrative in order to present a story that no longer revolves around the metanarrative of life, but that of death. Temporal distortion, distorting linear time narrative, especially while incorporating dead characters in the story is a postmodern technique. Postmodernism allows for breaks in linearity and chronology which was not possible in previous literatures. Moreover, in literatures of previous times, life occupied the central position and was focused upon in terms of positionality. Death was pushed to the boundaries and was either rarely mentioned or not mentioned at all. However, in its definition, postmodernism deals with the subversion of metanarratives. Life had been a grand narrative prior to the advent of postmodernism. Hence, with its arrival, it subverted all grand narratives and brought neglected narratives to light. The present study deals with such novels where death is focused upon. It occupies the central role in the novels and pushes life to the margins. Hence, through the use of temporal distortion, both Miller and Lockhart have created such plots which able to dismantle the metanarrative of life and establish the otherwise neglected narrative of death over it.

Keywords*:* Postmodernism, Metanarratives, Temporal distortion, Chronology, Linear narratives

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More Real Than Real: Hyperreality and the AI Aesthetic in *Black Mirror* through Baudrillard's Theory

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In the post-digital era, artificial intelligence (AI) has changed from a tool for help to an active participant in creating, curating, and experiencing reality. The cultural effects of this change are clearly shown in Netflix's *Black Mirror* season 7, a show that questions how the lines between reality and simulation are blurring. Baudrillard's theory says that simulations not only reflect reality but also change it and even become better than it, creating a world where representation erases the real. This study uses a postmodern theoretical framework that is based on Baudrillard's stages of simulacra to look closely at the events through textual and visual analysis. This method allows a more complex understanding of how Black Mirror creates hyperreal worlds controlled by AI technologies by looking at story structures, aesthetic devices, and the ethical questions they raise. The results show that the show constantly puts its characters in situations where digital consciousness, synthetic memory, and emotional AI make the settings seem more real than real life. The fact that characters are relying more and more on immersive models and computer-generated identities shows a state in which performance overpowers truth and reality falls apart into showiness. These situations show the rise of "posthuman subjectivity," in which digital interaction completely changes the limits of human identity, memory, and emotional reality. In the end, it is said that Black Mirror shows AI not only as a technical tool, but also as the creator of hyperreality in science fiction and fantasy. By showing how alluring and dangerous synthetic realities can be, the show criticizes how modern society makes it seem normal to replace reality with simulation. As the study shows, this change has moral, existential, and cultural effects. It adds to the discussion of postmodern literature by showing AI as both a creator of hyperreality and a destabilizing force that erases reference, validity, and the human condition itself.

Keywords: Hyperreality, AI aesthetic, Simulation, Digital identity, Posthumanism, Science fiction

Alienation in Hamid`s The Last White Man: A Marxist Study

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This research presents a comprehensive Marxist analysis of alienation in Mohsin Hamid's 2022 novel, *The Last White Man*. The study posits that the fantastical event of racial transformation, where white characters inexplicably turn black, functions as a profound allegory for the brutal socio-economic realities of capitalist society. Through a sustained symbolic framework, the white populace is interpreted as the bourgeoisie, the ruling class that owns the means of production, while the transformed black characters represent the proletariat, the alienated and exploited working class. The protagonist Anders's shocking metamorphosis and subsequent experiences are meticulously examined through the lens of Karl Marx's theory of alienation, specifically his four forms: alienation from the product of one's labor (symbolized by positive social reactions), from the process of production (social interaction and communication), from one's fellow workers (other transformed individuals), and most critically, from one's species-being. Marxist critique with psychoanalytic theory and archetypal criticism, this study delves into the severe psychological repercussions of this systemic estrangement. The textual analysis reveals how capitalist mechanisms—mirrored in the novel by media propaganda, social prejudice, and violent riots—manufacture deep-seated trauma, and profound social dislocation. The narrative exposes the toxic and inherently oppressive relationship between the classes, demonstrating how it corrodes individual autonomy and communal bonds. The study concludes that the novel suggests viable pathways to mitigate alienation through the achievement of self-actualization, the development of a unified class consciousness, and the crucial formation of empathetic, humanizing connections across economic divides. Hamid's work, therefore, serves as both a stark warning about the dehumanizing effects of capitalism and a hopeful appeal for a more conscious, connected, and equitable social order.

Keywords*:* Marxism, Capitalism, Class-consciousness, Identity crisis, *The Last White Man*

Her Language, Her Prestige: Sociolinguistics in Pakistani Campuses

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Women have to follow a certain set of behavioral standards to be accepted by society in a male-dominated culture. This study shows how Pakistani female students use language to maintain their prestige in male-dominated classes. Pakistani female students utilize language to maintain their prestige and navigate their identities within male-dominated academic institutes by refraining from slangs or being over talkative, maintaining the social boundaries within a Pakistani society. From deliberate code switching in seminars to silence in group discussions, the Pakistani women navigate prestige as both shield and sword. By applying *Bourdieu's theory of Linguistic Capital* and merging it with *Coupland's concept of style shifting*, this research examines how Pakistani female students deliberately alter speech patterns to exhibit prestige and negotiate power dynamics in campuses with co-education. Bourdieu describes linguistic capital as a form of cultural capital, and specifically as the accumulation of a single person's linguistic skills that predetermines their position in society as delegated by powerful institutions. Through a mix method of linguistic analysis and interviews, the societal and cultural forces affecting Pakistani girls choosing language in co-educational settings, in digital as well as offline platforms are reSvealed. Pakistan is not an exception to this reality in context of language being a tool of communication and identity, as it , additionally, reflects many forms of social status and power. Through this research, the powerful dynamics of women empowerment can be highlighted and also it provides new findings into the context of gender inclusivity.

Keywords: Sociolinguistics, Pakistani students, Females, Language, Speech patterns

The Psychological Impact of Instructor Language on University Students: A Comparative Analysis with *Taare Zameen Par* on Student Behavior, Learning, and Emotional Well-Being

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This study explores the psychological impact of instructor language on university students, with a comparative lens drawn from the film Taare Zameen Par. Utilizing Vygotsky's Sociocultural Theory and Bandura's Social Learning Theory, these framework investigates how empathetic versus authoritative language influences student behavior, learning outcomes, and emotional well-being. Qualitative method is applied to this research and it's focus groups and thematic analysis contextualize these findings through student reflections and response in study and overall behavior. The study aims to identify correlations between instructor language and positive emotional and behavioral outcomes, highlighting the relevance of empathetic communication modeled in Taare Zameen Par. The findings suggest that supportive, encouraging instructor language enhances motivation, engagement, and emotional regulation. This research contributes to the broader understanding of how language shapes learning experiences and offers practical implications for fostering emotionally supportive academic environments.

Keywords*:* Instructor language, Empathetic influence, Sociocultural learning, Social learning

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Behind the Nobel Curtain: Patriarchy and Erasure of Women in Science

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This paper examined the marginalization of women who had done wonders in the field of science and history but men got the credit for it. The rejection of the gender-biased society towards these genius minds whose contributions were overshadowed by their male counterparts restraining them from getting the prestigious recognitions like Noble Prize. The research critically analyzed the systematic erasure of five pioneering women scientists: Rosalind franklin, Jocelyn Bell Burnell, Lies Mietner, Chein Shiung Wu, and Mileva Maric. This qualitative study utilized primary and secondary resources including personal archival material, journals, letters, scientific publications and most importantly Noble record committee. The study primarily analyzed the patterns of exclusion and tokenism and the patriarchal norms that stayed within the scientific community. Moreover, by using interdisciplinary feminist lens and discourse analysis this study also interrogated entrenched patriarchy and deep-rooted misogyny that minimized the intellectual labor of these women. These frameworks helped us to uncover the gendered criteria of credibility, recognition, and accountability. The findings of the study revealed that scientific media showed the distorted image of these women and was among the most prominent reason for the biasness. The study also highlighted that marginalization of these women was a reflection of deep-rooted misogyny within the scientific structures. Furthermore, by bringing these stories to the forefront this study highlighted that the contributions of these women should be recognized. Similarly, there is need to reevaluate the standards by which scientific credits and recognitions are assigned.

Keywords*:* Media framing, Feminist discourse analysis, Patriarchal epistemology, Institutional sexism, Gender-biasness in STEM, Invisible labour, Noble prize, Discrimination

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The Uncivilized Civilizers: A Comparative Study of Silencing and Civilization Narratives in Heimskringla and A Passage to India

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In the history of Europe and Subcontinent, the concept of power and civilization hold a significant importance. In Viking era wars, raids and conquests were presented as mutual respect and heroism, while British Colonial era legitimizes such acts by calling them acts of civilization and development. Viking sagas often glorified power and bloodshed which can be traced further in the acts of colonization by the Britishers disguised as development and civilization. This research highlights the issue of *civilization* by the *uncivilized* by considering how the narrative is used to impose restrictions on certain voices. By focusing on a comparative analysis between *Heimskringla* (Viking Saga) and *A Passage to India* by E.M. Foster, this study explores how both, Vikings and Britishers, colonized brutally in guise of civilization. The theory of focalization by Gerard Genette is used to analyze the narrative with the focus on the predominant and the marginal voices. By juxtaposing *Heimskringla* (Viking Saga), a record of Viking's brutality, with colonial and post-colonial text like E.M. Foster's *A Passage to India,* this study demonstrates the British Imperialism as a new face of inherited barbarism in the guise of *civilizing mission*. Although there are separate studies on *Heimskringla* and *A Passage to India,* it remains to be seen on a comparative basis how narrative reinforces power relations and notions of civilization. This study reveals that the British *civilizing mission* was less a new, but continued act of conquest rooted in Viking barbarity than an act of progress and development also highlighting the selection and suppression of voices through narrative technique to shape social and political power. As such, this research is important for literary and historical studies and provides new insights into power, identity and social continuity.

Keywords*:* Vikings, Silenced voices, British colonialism, Indian subcontinent, Civilizing mission

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Unraveling Ryle's Character: A Trauma-Informed Analysis of Psychological Development in it ends with us

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This work examines the psychological and emotional effects of trauma on the character growth of Ryle Kincaid in the novel *It Ends With Us* by Colleen Hoover through Trauma-Informed Analysis to understand the influence of early exposure to violence and unresolved trauma on the development of his personality, behavioral patterns, and ultimately his behavior in the context of his romantic relationship. Ryle is represented as a charismatic, disciplined and a very successful neurosurgeon. But he struggles to deal with his anger and emotional instability that is caused by a traumatic childhood event of family violence. The study uses the character analysis, complex trauma theory to deconstruct the layers of the psychological portrait of Ryle. It contends the fact that Ryle has suffered trauma is no defense to his abuse but a valuable lesson on the repetitiveness of abuse and the psychological conflicts that survivors who turn to attackers are likely to experience. This paper also explores how Hoover employs the character of Ryle to critique readers expectations of morality, empathy and responsibility. It draws a conclusion that the case of Ryle is a heartbreaking example of how untreated trauma may impact emotional control, personal relationships, and self-development. This study adds to the greater debates about trauma-informed character growth in modern literature by exploring the inner conflicts and behavioral changes in Ryle. It also highlights the significance of psychological realism in literature as a means of empathy building and creating awareness in the context of domestic violence and mental health.

Keywords: Trauma, Domestic violence, Mental health, Psychological realism, Relationship, Self-development

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Profiling Through Language: A Critical Discourse Analysis of Interrogation and Power in Netflix's *Mindhunter*

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This research examined the use of language in constructing power relations during interrogation dialogues in Netflix's Mindhunter. The series portrays the early FBI efforts at criminal profiling, where interrogation scenes with serial killers highlight the role of discourse in negotiating authority, resistance, and identity. Previous studies on Mindhunter have addressed narrative structure, authenticity, and ideological themes, the linguistic dynamics of interrogation discourse remain underexplored. Critical Discourse Analysis (CDA) has often been applied to courtroom talk, police interviews, and emergency calls, but rarely to dramatized FBI interrogations in popular media. To address this gap, the study employed a qualitative CDA framework, drawing on Fairclough's three-dimensional model and van Dijk's framework of power in discourse. Selected scenes with Ed Kemper, Jerry Brudos, and Richard Speck were transcribed and analyzed for speech acts, turn-taking, modality, and lexical strategies. The findings suggested that FBI agents frequently employ directive and controlling discourse to assert dominance, yet killers often resist through evasiveness, narrative expansion, humor, and reframing, sometimes destabilizing institutional power. This indicated that profiling is not a one-sided process but a discursively co-constructed practice. The study contributed to discourse studies, forensic linguistics, and media analysis by revealing how dramatized interrogations mirror broader cultural understandings of crime and authority.

Keywords*:* Critical discourse analysis, Interrogation, Power, Media, Crime

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Linguistic Dimensions of Cerebral Palsy: Enhancing Communication and Understanding

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This study investigates the communicative patterns of individuals with cerebral palsy (CP) through the theoretical framework of Speech Act Theory, emphasizing the relationship between motor speech impairments and pragmatic language use. Data were collected through standardized speech assessments, semi-structured interviews, and pragmatic analyses of conversational exchanges to develop a holistic understanding of how dysarthria affects interaction. Findings indicate that dysarthria significantly reduces speech intelligibility and slows verbal output, which often leads to conversational breakdowns; nevertheless, participants consistently attempted to preserve communicative intent and engage in appropriate speech acts despite physical constraints. These observations highlight the resilience of pragmatic competence in the presence of disordered speech and point to the crucial role of supportive systems. Augmentative and alternative communication (AAC) technologies proved particularly effective, as they facilitated conversational turn-taking, supported mutual intelligibility, and narrowed the gap between intended and perceived meaning. The study underscores the necessity of linguistically informed intervention strategies that approach language as a performative act, prioritize shared understanding, and integrate technological support to improve communicative efficacy. The results carry important implications for clinical practice and social inclusion, suggesting that interventions combining pragmatic competence training with AAC can empower individuals with CP to participate more fully in social and educational settings, thereby enhancing both quality of life and interpersonal connectedness.

Keywords: Cerebral palsy, Speech act theory; linguistics; AAC; Communication

English Language and Literature
Poster Presentations

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Beyond Humanism: Intersections of New Materialism and Object-Oriented Ontology

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This abstract explored the profound philosophical intersections between two contemporary schools of thought, New Materialism and Object-Oriented Ontology**.** Both philosophies challenged the long-standing anthropocentric bias of Western thought, which has historically privileged human subjectivity and consciousness while referring non-human entities to a subordinate passive role. By examining their shared and different routes this analysis suggested that a powerful post humanist framework emerges from their union. New materialism emphasized the vibrant productive agency of matter itself. Moving beyond the traditional subject-object contrast it argued that matter is not passive but an active participant in social political and cultural processes. Key concepts such as Karen Barad's interaction and Manuel DeLanda's collections highlighted how material-discursive practices constitute reality. Concurrently Object-Oriented Ontology as articulated by thinkers like Graham Harman activists for a "flat ontology" where all objects whether a rock, a planet or a human being exist equally and originally from one another and from human perception. This radical equality critiques the undermining and overmining of objects by previous philosophical traditions. While New Materialism focuses process and relationality, and titleholders the withdrawn remote reality of the individual object their combined force offers a critical redirection. Their shared critique of correlation the idea that existence is only accessible in relation to a human mind unites them in a common project. Ultimately, this study contended that the dialogue between New Materialism and provides a fertile ground for developing new ethical, ecological and political paradigms, pushing our intellectual horizons firmly beyond the confines of humanism to truly engage with a world of vibrant and complex non-human actors.

Keywords*:* Materialism, Humanism, Ontology, Ecology, School of thought

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The Madwoman Reconsidered Feminist Psychoanalysis of Rhys' W*ide Sargasso Sea.*

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This paper, examined Jean Rhys's reimagining of Bertha Mason/Antoinette Cosway through the theoretical lens of feminist psychoanalysis. Antoinette's descent into madness is examined as the unavoidable result of the painful interaction between patriarchal dominance and colonial relocation, rather than just as a case of mental instability. This study examines how Antoinette's identity was fragmented and her voice was silenced in both social and household settings by utilizing important psychoanalytic ideas such as Lacan's mirror stage. Here, her madness which is frequently reduced to a stereotype in Charlotte Brontë's Jane Eyre is reconsidered as an act of resistance that challenges the patriarchal order as well as a sign of psychic oppression. The symbolic role of Antoinette's confinement in the attic as a psychoanalytic site of psychological imprisonment, isolation, and suppression. Her shattered psyche and the larger suppression of women's voices under colonial and patriarchal authority are symbolized by this physical space. By bridging feminist and psychoanalytic perspectives, the analysis demonstrates how Rhys exposes the intersections of gender, race, and power, challenging the historical erasure of Creole identity. Antoinette's struggle with her mirror image, shaped by Rochester's denial of her selfhood, highlights the disintegration of subjectivity and the violence of colonial-patriarchal definitions of identity. The study offered a sophisticated interpretation of Antoinette's insanity as a sign of psychological trauma as well as a feminist act of resistance that challenges colonial and patriarchal-systems.

Keywords: Madness and identity, Colonialism and patriarchy, Creole identity

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Beyond Innate Evil: A Psychological Situational Reading of Golding's *Lord of the Flies*

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In literature, mostly human evil is portrayed as innate and a constant factor of human nature and William Golding's novel *Lord of the Flies* is a visible example of it. Critics study the text under the assumption that there is an inherent moral and inner corruption at the core of human nature that emerges when the social structure breaks down. However, the main point of this research is questioning whether Golding's novel confirms the concept of *Innate Evil* or represents human behavior in a more complex and situational way? This study uses *Psychological Situational Theory* as critical framework and argues that the boys' actions are not result of innate evil, rather they are shaped by extraordinary circumstances in which they were caught. Factors such as isolation, collapse of authority, struggle of survival, and group pressure play a fundamental role in the reconstruction of their moral decisions, inter-relationships, and shaping their identity. Through this theoretical perspective, this research emphasizes that *Lord of the Flies* cannot be limited to the concept of innate evil. Rather, it can also be seen as an example of how circumstances and environments shape human behavior. In this way, the study challenges traditional criticism and provides an alternative interpretation that helps us understand human nature at a more flexible, contextual, and psychological level.

Keywords: Innate evil, Social structure, Human nature, Psychological perspective, Situational behavior

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Ecofeminism and Environmental Catastrophe: Human Resilience in Rae Meadows' *I Will Send Rain*

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The research analyze how female suffer through out environmental degradation by examining the novel *I will send rain* written by Rae meadow through eco-feministic approach. The research embeds that much eco-feminist criticism treat women and nature as homogeneous categories; less attention is paid to how diverse gendered bodies young/old, disabled, queer experience and perform resilience in climate crisis narratives .The study evaluate text through the method of textual analysis such as close reading, feminist phenomenology, textual analysis of bodily metaphors and care giving scenes. This research examines how mother Annie strives to hold her family and farm together to survive through starvation, deprivation, and health issues in dust bowl .They hope to keep a bit of their souls alive as well .A novel analysis through this lens and method produce new insights to survive in environmental devastation and the relationship of female protagonist and environment that builds a connection between gender oppression and environmental challenges to raising awareness and inspiring actions of human resilience.

Keywords: Eco-feminism, Environmental catastrophe, Human resilience, Dust blows, Starvation

Eco-Criticism and Climate Fiction: A Critical Analysis of *The Hungary Tide* through Huggan's Lens

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The aim of this research is to study South Asian climate fiction with the particular focus on Amitav Ghosh's novel *The Hungary Tide.* The novel shows environmental anxieties, social and political issues faced by the communities living in climate affected areas.The main objective is to demonstrate how literature combines ecological concerns with social political struggles and human survival. Past researches on eco-criticism and climate fiction have been western focused and limited to some certain genres, neglecting South Asian voices and struggles. Climate change is one of the most pressing, underestimated and alarming reality at present era that are affecting both human life and natural environment. Although climate fiction has remained on focus in western texts such as Margaret Atwood but remained under researched in South Asia. There is need of highlighting these perspectives to understand how climate issues are experienced and explained in local, cultural and social context. Cheryll Glotfelty and Lawrence Buell's theory of Eco-criticism and Graham Huggan's theory of Post-Colonial Eco-criticism helps to link literature natural environment and colonial history and how post-colonial eco-criticism is applied to examine the relationship of ecological issues with colonial history and power structure. This result demonstrates the ways in which literature helps to transform climate concerns into lived experiences of vulnerable communities. Climate change is one of the biggest challenge faced by South Asian countries. The study explores how literature acts as a vital tool for promoting climate awareness. This research introduces eco-criticism to South Asian literature, how humanities especially literature can connect scientific discussions, climate crisis and contribute to foster policy formation environmental responsibility and importance of a wide-ranging voices in global debate.

Keywords: Eco-criticism, Climate fiction, Post-colonial, South Asia

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Islamic studies
Oral Presentations

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Reviving Women's Qurʾānic Scholarship in Steam Education: Promoting Gender Equity and Ethical Inquiry

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STEAM education inclusivity, social-emotional learning, and cultural responsiveness alongside technical skills, yet the contributions of early Muslim women scholars in Qurʾānic and Hadith studies remain underutilized in such frameworks. This study proposes an innovative STEAM pedagogical model that integrates the intellectual legacy of historical Muslim women scholars to foster gender-equitable epistemic authority and ethical inquiry. Through a historical-analytical review of female scholars' contributions and design-based research, the study develops curriculum modules incorporating storytelling, digital tools, and collaborative projects to emulate their scholarly methods in the STEAM contexts. Initial trials reveal increased female student engagement, stronger epistemic identity, and enhanced empathy in interdisciplinary learning environments. Integrating women's scholarly heritage into STEAM education has enriched moral reflection, creativity, and collaborations across diverse classrooms. This approach not only rectifies historical oversight but also models epistemic diversity, cultivating inclusive of the ethically grounded learners. By embedding women's Qurʾānic scholarship into STEAM pedagogy, this study advances gender equity and ethical learning, and contributes to a more inclusive educational paradigm.

Keywords: Women's Islamic scholarship, STEAM education, Gender equity, Ethical inquiry, Epistemic diversity

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Prophet Muhammad (ﷺ) and The Foundation of Human Rights: An Analytical Study

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The life and teachings of Prophet Muhammad (ﷺ) present a comprehensive framework for the protection and promotion of human rights that transcends time, culture, and geography. Long before the modern charters of human rights emerged, the Prophet established principles that ensured justice, equality and dignity for all human beings, regardless of race, gender, or social status. This study explores the Seerah of the Prophet Muhammad (ﷺ) as a foundational source for understanding universal human rights. Through an analytical study of selected events and teachings such as the Charter of Madinah, the Farewell Sermon, and the Prophet's interactions with women, non-Muslims, and the oppressed this research highlights how the Prophet institutionalized social justice, freedom of conscience, and respect for human dignity within an Islamic framework. Moreover, the paper compares these early Islamic principles with contemporary human rights concepts to demonstrate the enduring relevance of the Prophet's moral and legal vision. The findings reveal that the Seerah offers not only theological guidance but also a practical model for modern societies seeking justice and compassion in governance and interpersonal relations. Thus, the life and legacy of the Prophet Muhammad (ﷺ) remain an indispensable source for developing a humane, ethical and just global order.

Keywords: Human rights, Social justice, Equality, Charter of Madinah, Islamic ethics

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Enhancing Islamic Studies in Pakistan: Addressing Challenges, Improving Standards, and Guiding Research Directions

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The subject of Islamic Studies in Pakistan's colleges and universities occupies a distinctive place in the nation's educational framework, functioning simultaneously as a marker of identity, a field of scholarly inquiry, and a space of debate on religion's role in modern life. However, it faces significant challenges that hinder its effectiveness and relevance. These include outdated and fragmented curricula, rote-based teaching methods, insufficiently trained teachers, weak research culture, and the persistence of sectarian and exclusivist tendencies. Institutional shortcomings, politicization, and inadequate use of modern pedagogical tools further compound these issues. To enhance its quality and relevance, this paper advances a comprehensive reform agenda. It calls for outcome-based curriculum redesign, teacher professionalization, incorporation of active-learning pedagogy and critical thinking, and the adoption of robust assessment and quality assurance mechanisms. Greater integration of Islamic Studies with STEM and social sciences, alongside modules on civic responsibility, pluralism, and interfaith relations, is also emphasized. The use of digital resources and provision of institutional incentives for research are seen as essential to modernizing the discipline. Finally, the paper identifies priority research directions that can support these reforms, including curriculum evaluation, pedagogical innovations, comparative and interdisciplinary studies, public perception surveys, and policy implementation research. Such initiatives will not only strengthen the academic credibility of Islamic Studies but also align it with contemporary intellectual, social, and civic challenges. The recommendations offered are actionable and consistent with recent curriculum revisions and policy directions of the Higher Education Commission of Pakistan.

Keywords: Islamic studies, Challenges, Curriculum, Teaching and research directions, Politics

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Seerah of the Holy Prophet Provides a Powerful Framework of Human Rights for Making Peaceful Society

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The Seerah, the meticulously documented life and teachings of the Holy Prophet Muhammad (Peace Be Upon Him), offers a profound and divinely inspired framework for human rights that is essential for establishing a just and peaceful society. This framework, established in the 7th century, predates modern conventions and provides a comprehensive, timeless model rooted in divine wisdom and practical application. The Prophet's life exemplifies the core principles of human dignity, equality, and social justice, challenging the oppressive norms of pre-Islamic Arabia. Central to this framework is the sanctity of life, property, and honor, unequivocally established in his Farewell Sermon. The Seerah champions the rights of the most vulnerable women, orphans, slaves, and religious minorities granting them legal status, inheritance rights, and freedom of conscience. The Constitution of Medina stands as a pioneering historical document, establishing a pluralistic society based on citizenship and mutual obligations between Muslims and non-Muslims, rather than tribal affiliation or faith alone. Furthermore, the Prophet's conduct in war, emphasizing proportionality, the protection of non-combatants, and the humane treatment of prisoners, set revolutionary ethical standards. His unwavering commitment to justice, compassion, and forgiveness, even towards his staunchest opponents, provides a powerful blueprint for conflict resolution and social harmony. By anchoring human rights in spiritual and moral imperatives, the Seerah offers a holistic and sustainable paradigm. It moves beyond mere legalism, fostering a society where individual rights are balanced with communal responsibilities, ultimately creating the foundation for enduring peace and coexistence.

Keywords: Seerah, Human rights in Islam**,** Constitution of medina**,** Social justice

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Reimagining Qurʾānic Narratives in STEAM Education: Fostering Ethical Innovation and Cognitive Integration

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Steam pedagogy, integrating science, technology, engineering, arts, and mathematics, emphasizes creativity, emotional intelligence, and interdisciplinary thinking, yet Qurʾānic narratives remain underexplored as cognitive tools within such frameworks. This study introduces a novel pedagogical model that leverages Qurʾānic narrative techniques—metaphors, analogies, and ethical exemplars—to enhance critical thinking, creativity, and ethical reasoning in STEAM education. Through a conceptual-analytical approach, the study synthesizes classical tafsīr (Qurʾānic exegesis) with contemporary STEAM pedagogy research, developing a prototype educational module that employs Qurʾānic narratives to foster problem-based learning and design-thinking. Pilot implementations in classroom simulations demonstrate heightened student engagement, improved ethical reasoning, and deeper reflective thinking across diverse STEAM disciplines. Qurʾānic narratives served as cognitive anchors, enriching imaginative problem-solving and moral deliberation. This model bridges Islamic epistemology with modern education, offering a pioneering approach to ethical innovation and cognitive integration. By embedding Qurʾānic narrative structures into STEAM pedagogy, this study cultivates holistic intellectual and spiritual development, contributing to innovative, ethically grounded learning experiences.

Keywords: Qurʾānic narratives, Steam pedagogy, Ethical innovation, Cognitive integration, Interdisciplinary learning

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Ethics and Morality in Islam: Principles and Practices for a Better World

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Ethics and morality in Islam occupy a central place in guiding individual behavior, social relations, and global human interaction. Rooted in the Qur'an and the teachings of the Prophet Muhammad (peace be upon him), Islamic ethical principles emphasize justice (عدل), compassion (رحم), honesty(صدق), trustworthiness (امانہ), and respect for human dignity (کرامہ). These values are not merely theoretical ideals but are intended as practical frameworks that shape everyday life and ensure social harmony. Islam integrates morality with spirituality, creating a holistic approach where acts of worship are inseparable from moral conduct. For example, prayer is meant to prevent indecency and wrongdoing, while fasting cultivates self-restraint, empathy, and social responsibility. On a societal level, Islamic ethics promote fairness in economic dealings, transparency in governance, mutual consultation (شورہ), and the protection of human rights. The principles of accountability and stewardship also extend to environmental care, recognizing humanity's role as custodians (خلفاء) of the earth. These dimensions illustrate how Islamic morality provides guidance not only for personal piety but also for building just institutions and sustainable communities. In today's world of increasing materialism, conflict, and ethical relativism, the Islamic moral system offers timeless solutions to contemporary challenges. Its insistence on truthfulness counters corruption and misinformation, its stress on justice confronts social inequalities, and its call for compassion addresses global humanitarian crises. The universality of these principles demonstrates their relevance for fostering peaceful coexistence and cooperation among diverse cultures and nations. By examining both principles and practices, this paper argues that Islamic ethics constitute a comprehensive model for a better world—where morality is not an abstract concept but a lived reality. The integration of faith, morality, and social responsibility in Islam thus provides enduring guidance for individuals and societies striving toward peace, equity, and mutual respect.

Keywords: The Holy Quran, The books of hadith, The books of Fiqh

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The Prophet Muhammad (S.A.W.) as the Champion of Human Rights: A Historical and Contemporary Study

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The Holy Prophet Muhammad (Peace Be Upon Him) emerged as a unique and unparalleled figure in human history, whose life and teachings continue to inspire humanity across centuries. At a time when the Arabian society was characterized by tribal discrimination, social inequality, and moral decline, he laid down principles that became the foundation of universal human rights. He championed equality, justice, compassion, and human dignity, while safeguarding the rights of the marginalized, including women, children, slaves, and the poor. This research examines the Prophet's role as the champion of human rights from both historical and contemporary perspectives. Historically, the Prophet (peace be upon him) transformed a fragmented society into a community based on justice, mutual respect, and moral accountability. His reforms emphasized the sanctity of life, protection of property, freedom of belief, and social justice, long before these principles were articulated in modern human rights charters. Contemporary analysis further highlights the relevance of his message in addressing global issues such as injustice, exploitation, cultural conflict, and violations of human dignity. By drawing parallels between historical precedents and present-day challenges, this study argues that the Prophetic model offers timeless guidance for building an ethical and equitable society. The findings demonstrate that the Prophet's teachings provide not only a comprehensive moral framework but also a practical roadmap for safeguarding human dignity and justice in the 21st century and beyond.

Keywords: Holy Prophet (SAW), History, Equality, Human rights, Contemporary challenges

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The Concept of Environmentalism: Philosophies Behind It: (in Islamic Perspective)

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Environmentalism in contemporary thought is often articulated within secular, ethical, or socio-political frameworks. However, within the Islamic worldview, environmental consciousness arises from profound theological and philosophical principles rather than modern ideological constructs. This study explores the Islamic philosophy of environmental stewardship as an integral component of faith, deeply rooted in the Qur'an and the Sunnah of the Prophet Muhammad (PBUH). It identifies three foundational pillars, Tawhid (Oneness of God), Khilafah (Vicegerency), and Amanah (Trust) as the core of this ecological ethic. Tawhid affirms the unity, order, and sacredness of creation as a reflection of divine purpose, thereby rejecting any anthropocentric view that legitimizes exploitation. Khilafah designates humanity as the steward of the Earth, entrusted with maintaining ecological balance through justice, compassion, and accountability. Amanah further reinforces this responsibility, framing environmental care as a moral and spiritual obligation. The Islamic ethical framework operationalizes these principles through practical injunctions—prohibition of waste and extravagance (israf), promotion of life and cleanliness, establishment of protected natural zones (hima), and recognition of the rights of all living beings (huquq al-'ibad). Thus, the Islamic vision transcends the materialistic limitations of modern environmentalism by situating ecological preservation within a holistic paradigm of worship and moral duty. It interprets environmental degradation as a manifestation of spiritual imbalance, calling for a revival of divine consciousness in human-environment relations. Ultimately, Islamic environmentalism offers a spiritually grounded and sustainable model, where caring for nature becomes an expression of faith and an act of fulfilling the divine trust on Earth.

Keywords: Islamic environmentalism, Tawhid, Khilafah, Amanah, Ecological ethics

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The Role of Social Media in the Growth of Islamic Society

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Social media has become a key tool in shaping Islamic societies by promoting Islamic values, knowledge dissemination, and community engagement. This study examines how platforms like Facebook, Twitter, Instagram, and YouTube contribute to religious education, social cohesion, and dawah activities. A qualitative approach was adopted, including literature review, content analysis of Islamic social media pages, and case studies of successful digital activities. Results indicate that social enhances access to Islamic teachings, encourages intergenerational learning, and supports charitable and awareness campaigns. Challenges include misinformation, content misinterpretation, and online polarization. This study concludes that effective use of social media can foster unity, ethical engagement, and overall growth in Islamic communities.

Keywords: Social media, Islamic society, Community building, Digital outreach

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Interdisciplinary Research in STEAM: Emerging Global Trends and Future Directions

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In the 21st century, the integration of Science, Technology, Engineering, Arts, and Mathematics (STEAM) has emerged as a dynamic paradigm for innovation and knowledge creation. Interdisciplinary research within STEAM transcends traditional academic silos, fostering collaboration between diverse fields to address complex global challenges such as climate change, digital transformation, sustainable development, and cultural inclusivity. By embedding the Arts alongside STEM disciplines, this framework emphasizes creativity, critical thinking, and human-centered approaches, making it highly relevant in the context of globalization and technological acceleration. The central research question guiding this study is: How are interdisciplinary approaches in STEAM shaping global research trends, and what implications do these hold for education, industry, and policy? This inquiry is significant because it highlights not only the practical applications of STEAM but also the evolving nature of knowledge production in a rapidly interconnected world. The methodology of this study is qualitative and exploratory. It employs a systematic review of recent scholarly literature, policy documents, and case studies from diverse geographical regions. Comparative analysis is used to identify patterns, innovations, and gaps in current STEAM practices, while thematic coding highlights recurring global trends such as digital learning ecosystems, sustainability-driven innovations, and cross-cultural collaborations. The findings aim to contribute to ongoing debates on the future of interdisciplinary education and research, offering recommendations for policymakers, educators, and researchers to leverage STEAM as a transformative tool for solving real-world problems in the global knowledge economy.

Keywords: STEAM education, Interdisciplinary research, Global trends, Knowledge economy

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Seerah and Human Rights, Exploring the Life, Teaching, and the Legacy of Prophet Muhammad

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The Seerah of Prophet Muhammad ﷺ is far more than a biographical record; it is a living, breathing example of moral excellence and the embodiment of universal human rights. At a time when injustice was normalized, women were dehumanized, the poor were voiceless, and slaves were treated as property, the Prophet ﷺ rose with a message that transformed not only Arabia but eventually the entire world. His life was a revolution of compassion, equity, and dignity — values that modern human rights frameworks echo centuries later. This study seeks to explore the life, teachings, and legacy of the Prophet Muhammad ﷺ through the lens of human rights and emotional human values. From his earliest teachings in Mecca—where he protected the weak and challenged elite oppression—to his leadership in Medina—where he built a multi-faith, rights-based society—the Seerah presents a deeply emotional and ethical journey that defines what it means to be truly human. This topic does not only analyze historical events; it invites us to feel the weight of Bilal's chains as he was tortured for his faith, to hear the cry of the orphan comforted by the Prophet ﷺ, and to witness how mercy softened even the hardest hearts. His farewell sermon alone stands as a charter of rights for all mankind, asserting the equality of all humans regardless of race or status. In today's world, where injustice and dehumanization still exist in many forms, studying the Seerah is not only a religious or academic pursuit—it is a moral responsibility. It challenges us to embody the Prophetic spirit of empathy, justice, and love for all creation.

Keywords: Excellence, Human rights, Voiceless, Prophet Muhammad ﷺ, Society

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The Role of Social Media in Growth of Islamic Society

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Social media has emerged as a powerful tool in shaping and strengthening Islamic society by fostering communication, education, and unity among Muslims worldwide. It provides a platform for sharing Islamic knowledge, promoting awareness of religious values, and engaging in discussions that address contemporary challenges. Through online lectures, Quranic teachings, and scholarly debates, social media enhances access to authentic religious guidance. Moreover, it connects communities, supports charitable initiatives, and amplifies the voice of Muslims on global issues. At the same time, social media contributes to the moral and intellectual growth of individuals by providing opportunities for continuous learning and interaction with diverse perspectives. It encourages youth participation in religious activities, spreads awareness about Islamic culture, and highlights issues of social justice from an Islamic lens. Campaigns for charity, humanitarian relief, and community development often gain momentum through these platforms, making them valuable in promoting solidarity. However, the challenges of misinformation, misinterpretation of Islamic teachings, and misuse of digital spaces also exist. Therefore, responsible engagement and reliance on authentic sources are essential. Overall, social media plays a significant role in nurturing the values, unity, and progress of Islamic society in the modern age.

Keywords: Social media, Islamic society, Religious education, Moral growth, Community development

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The Role of Social Media in the Development of an Islamic Welfare Society in the Light of Islamic Teachings

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Social media now plays a significant role in our everyday lives and has a big impact on how people connect, learn, and think. This study talks about how social media can help build an Islamic welfare society when it is guided by Islamic values. Islam teaches honesty, fairness, kindness, and the love of learning — all of which are important for creating a peaceful and caring community. This study used a qualitative review of Islamic principles related to good communication (adab) and social justice ('adl). The findings show that when these values are followed online, social media can become a platform for sharing knowledge, spreading good morals, and supporting social welfare. Teachers and scholars can use it to make Islamic knowledge easier to access and to inspire positive change among young people. Students can also learn to use social media wisely, which helps them grow in both understanding and character. However, if social media is used without Islamic ethics, it can lead to false information, arrogance, and moral decline. Therefore, it is important to connect modern technology with Islamic principles so that progress stays in line with faith. In this way, social media becomes more than just a communication tool it also becomes a means for education, da'wah, and building a truly Islamic welfare society.

Keywords: Social media, Islamic ethics, Welfare society, Digital da'wah, Education

The Role of Social Media in the Development of Islamic Society

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In the contemporary era, social media has emerged as a comprehensive and rapidly evolving medium of communication that not only reinforces interpersonal connections within Islamic society but also plays a pivotal role in disseminating religious consciousness. This study elucidates that social media has significantly broadened the scope of interaction, dialogue, and intellectual exchange across the Muslim Ummah. Consequently, scholars and preachers have become capable of conveying the teachings of the Qur'an and Sunnah on a global scale, while ordinary Muslims actively contribute to mutual moral reform and spiritual training through religious posts, lectures, and scholarly content. This process fosters social cohesion, religious awakening, and the development of a social framework rooted in the principles of the Qur'an and Sunnah. The study further highlights that social media has effectively transformed the world into a "global village," enabling individuals from any location to listen to scholarly discourses, ask questions, and obtain immediate religious guidance. Hence, these platforms introduce new possibilities for nurturing an intellectually enlightened, morally conscious, and spiritually cultivated Islamic society. Nevertheless, the research also examines the adverse dimensions of social media. Immorality, frivolous discourse, time wastage, and exposure to unethical content threaten the fundamental Islamic values of altruism, sacrifice, kinship, and respect. Among the youth, the pursuit of fame, superficial behavior, and indecorous communication patterns are contributing to social disintegration—posing serious challenges to the moral fabric and spiritual essence of Islamic society. Employing a narrative and analytical research methodology, this study draws evidence from the Qur'an and Sunnah and references the Seerah of the Prophet Muhammad ﷺ to illustrate that through the constructive and purposeful use of social media, it is possible to establish a system that nurtures justice, love, cooperation, and religious consciousness—thereby transforming Islamic society into an exemplary and unified model.

Keywords: Islamic society, Social media, Qur'an and Sunnah, Religious awareness

Prophet Muhammad (S.A.W.): A Universal Role Model for Human Rights Activists

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Hazrat Muhammad (S.A.W.) serves as a powerful and enduring model for human rights advocacy, both within Islamic tradition and in a broader, global context. At a time marked by deep social inequality, tribalism, and injustice, his teachings introduced a transformative ethical system grounded in the inherent dignity and equality of all human beings. Through his personal conduct, community leadership, and foundational documents like the Constitution of Madinah, the Prophet (S.A.W.) emphasized the protection of life, freedom of belief, social justice, and the rights of marginalized groups including women, children, slaves, and religious minorities. This paper explores the Prophet's (S.A.W.) role as a universal advocate for human rights by examining key events from his life, the principles found in the Qur'an, and his sayings (Hadith). It discusses how his actions reflected values that align closely with modern human rights frameworks, such as non-discrimination, economic equity, fair treatment in conflict, and inclusive governance. Notably, the Farewell Sermon is analyzed as a comprehensive declaration of universal human values. By presenting Prophet Muhammad (S.A.W.) as a holistic leader who integrated moral values with social reform, this study argues that his legacy offers not only spiritual inspiration but also practical guidance for modern human rights activists. His message continues to resonate across cultures and communities, offering a timeless example of how to promote justice, compassion, and human dignity in every aspect of life.

Keywords: Prophet Muhammad (S.A.W.), Human rights, Constitution of Madinah, Compassion, Universal human values

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The Medina Charter as a Prophetic Framework for Pluralism and Human Rights

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The Medina Charter, drafted by the Prophet Muhammad in 622 CE, stands as one of the earliest known constitutional documents in history. It presents a prophetic framework that laid the foundation for a pluralistic society in the city-state of Medina, comprising Muslims, Jews, and other tribes. Far from being merely a political agreement, the Charter represents a vision of coexistence, mutual obligation, and respect for diverse religious and cultural identities. This paper explores the Charter's relevance as a pioneering model for human rights and pluralism, grounded in prophetic ethics rather than modern secular frameworks. The Charter's core principles freedom of religion, mutual defense, rule of law, and social justice highlight its commitment to human dignity and community cohesion. It recognized the rights and responsibilities of all members of the society, regardless of faith, and established a collective identity as the "Ummah" that included both Muslims and non-Muslims. In doing so, the Charter institutionalized a pluralistic political order that transcended tribal and religious divisions. By analyzing key clauses of the Medina Charter and comparing them with contemporary human rights principles, this paper argues that the Charter serves as a prophetic template for inclusive governance and interfaith harmony. In a time of increasing religious polarization and identity-based conflicts, revisiting this early Islamic model offers valuable insights for developing frameworks of coexistence grounded in justice and shared ethical values.

Keywords: Medina charter, Pluralism, Human rights, Prophetic ethics

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Prophet Muhammad's (ﷺ) Teachings on Humanitarian Ethics in War

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The Prophet Muhammad (PBUH) teachings on war provide a rich set of ethical and humanitarian principles that are very much in focus in the modern debate regarding conflict resolution and international humanitarian law. While war was generally marked by retribution, despotism, and uncontrolled violence. At that time the teaching of Hazrat Muhammad (PBUH) emphasized restriction, justice, and mercy. He prohibited the killing of non-combatants like women, children, elderly people, and monks, and instructed his companions not to incinerate crops, animals, or places of refuge. The Prophet (PBUH) also settled that Islam's warfare is purely defensive and engaged in only to safeguard religious freedom and repel aggression, never conquest, oppression, or for materialistic purposes. He maintained the sanctity of treaties, respected covenants with adversaries, and prohibited treachery and mutilation. Most importantly, he exhibited mercy and forgiveness in victory, such as during the Conquest of Makkah, where rather than exacting vengeance, he forgave his erstwhile persecutors. These humanitarian lessons are deeply in keeping with contemporary principles codified in the Geneva Conventions and international humanitarian law, demonstrating Islamic ethical principles pre-empted many of the world's contemporary norms. Prophet Muhammad's (PBUH) humanitarian ethics teachings in war will be analyzed in this paper to explore their historical practice and their utility for contemporary debate on justice, peace, and human dignity during conflict.

Keywords: Prophet Muhammad (PBUH) Seerah, Humanitarian ethics, Islamic law of war, International humanitarian, Human dignity

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Islam and Science: Addressing Contemporary Issues and Challenges in an Islamic Perspective

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The relationship between Islam and science has historically been one of harmony, as the Quran and the Sunnah encourage reflection, observation, and the pursuit of knowledge. Islamic civilization made profound contributions to mathematics, medicine, astronomy, and philosophy, laying foundations for modern scientific thought. Today, however, Muslims face significant challenges in reconciling scientific advancement with ethical, spiritual, and cultural values. Issues such as bioethics, artificial intelligence, climate change, genetic engineering, and digital technologies raise urgent questions that require responses grounded in Islamic principles. From an Islamic perspective, science is not merely a tool for material progress but a means to understand the signs of God in creation. The Qur'an repeatedly calls humanity to ponder the natural world, emphasizing balance (ميزان), stewardship (خلافہ), and responsibility. Thus, while Islam welcomes scientific progress, it places strong emphasis on ethical boundaries to ensure that innovation serves humanity without undermining morality, justice, or environmental sustainability. This paper examines contemporary issues such as the ethical use of biotechnology, environmental degradation, and the social impact of emerging technologies through an Islamic lens. It argues that the integration of scientific inquiry with Islamic ethics provides a holistic framework for addressing global challenges. By promoting knowledge that is both intellectually rigorous and morally conscious, Islam offers guidance for developing science in ways that preserve human dignity and foster the common good. Ultimately, the Islamic perspective presents science as a pathway not only to discovery but also to serving humanity and achieving harmony with creation.

Keywords: Significance, Balance, Stewardship, Advancement

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Islamic Ethical Framework for Artificial Intelligence: Towards Responsible Digital Future

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Artificial Intelligence (AI) is increasingly shaping modern societies by transforming governance, economics, healthcare, and education. While these advancements present unprecedented opportunities, they also raise pressing ethical, legal, and social concerns. This study seeks to explore how Islamic ethical frameworks can inform the responsible development and application of AI technologies. Drawing on the Qur'an, Hadith, and Islamic jurisprudence, the research identifies principles such as justice (عدلؑ), trustworthiness (امانہ), accountability (محاسبہ), and the preservation of human dignity (حفظ الکرامہ) as foundational guidelines for AI governance. The methodology involves a critical analysis of classical Islamic texts alongside contemporary debates in AI ethics, enabling the formulation of a faith-informed ethical framework. By bridging Islamic moral philosophy and modern technological discourse, the paper argues that AI must not only prioritize efficiency and innovation but also uphold spiritual and social responsibility. The findings contribute to global AI ethics discussions, highlighting how Islamic perspectives can enrich broader frameworks of responsible digital futures. This research ultimately provides a pathway for integrating faith-based ethical insights into policymaking, ensuring that technological advancement aligns with universal human values.

Keywords: Islamic ethics, Artificial intelligence, Digital futures, Responsible innovation technology

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Faith and Character Building Stories for Children: An Analytical and Potential Study of "Kashful Mehjoob"

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This paper is based upon the content selection of stories for children. Hazrat Sayyed Ali Hujveri (Rehmat-Ullah alaih)'s "Kashful Mehjoob" was the primary source of this selection process. The authentic Urdu and English translated versions of " Kashful Mehjoob" were consulted. Sayyed Ali Hujveri (Rehmat-Ullah Alaih) was a renowned philosopher, high – ranked intellectual and world- famous religious scholar. His meritorious and masterpiece work-"Kashful Mehjoob" is full of wisdom, intellect, faith, morality and character- building material for whole humanity. This study peculiarly focusses upon children's story literature perusal. Because, stories have special appeal for children, its objectives were: (1) to explore story type events and episodes from the pages of "Kashful Mehjoob", (2) to label those story type items with relevant titles, (3) to deduce interesting, innovative and reformative questions at the ending of scrutinized stories and (4) to identify the grade level for the selected stories. By methodology, it was a content analysis study. Five-point criteria was developed from literature review for sorting out story items. The Muslim faith and character building potential into the scrutinized instructional material was considered as key-point criterion. The conceptual, thematic and textual difficulty of the story material were got evaluated through a joint panel of five experts of Islamic Studies and Education Disciplines. Consequently, the study delivered a product of eight stories respectively for the students of grade one to eight. So, this study product had curricular and co-curricular significance for the children of primary and elementary classes in homeland and abroad.

Keywords: Faith, Character, Story, Children, Potential

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Building Muslim Communities through Online Platforms

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In recent years, social media and online platforms have played a growing role in shaping Muslim communities around the world. With the rise of digital communication tools such as Facebook, WhatsApp, Telegram, YouTube, and Instagram, Muslims now have greater opportunities to connect, share knowledge, and support one another regardless of geographic boundaries. This paper explores how these platforms are being used to build strong and active Muslim communities in the digital space. The study highlights how online platforms have become a source of Islamic learning, spiritual growth, and social support. Many scholars and organizations use social media to teach Qur'an, Hadith, and Islamic values, reaching a wide audience, especially among the youth. It also examines how Muslims come together online for charity campaigns, religious discussions, and global solidarity in times of crisis. These platforms help preserve Islamic identity, strengthen the sense of Ummah, and encourage unity among Muslims from different cultures and backgrounds. However, the paper also discusses some challenges, such as misinformation, lack of proper religious guidance, and the danger of online division. Despite these issues, the positive impact of digital tools in community building is clear and growing. By using these platforms wisely and ethically, Muslim communities can continue to grow stronger and more connected in today's digital world.

Keywords: Islamic community, Social media, Online platforms, Digital Ummah, Muslim unity

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Positive Impacts of Social Media on Islamic Values and Awareness

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In the present digital era, social media has become one of the most powerful tools for education, communication, and the exchange of ideas. For Muslims, these platforms provide new opportunities to share Islamic knowledge, promote values, and build a stronger sense of identity. Social media creates a space where Muslims from across the world can connect, discuss, and strengthen their bond as members of the global ummah. Through lectures, posts, and live sessions, Islamic scholars and organizations are able to deliver religious guidance to large audiences in a quick and effective way. A major benefit of social media is the easy access it provides to Islamic learning. Young Muslims, in particular, can now study the Qur'an, Hadith, and Islamic morals through digital lessons, online discussions, and short educational content. This accessibility helps them to improve their knowledge and practice Islamic values in their everyday lives. Furthermore, these platforms play a key role in presenting the true image of Islam by sharing messages of peace, compassion, and justice. Such efforts counteract the negative stereotypes and misconceptions that often surround Islam in the global media. Social media also supports community service and positive activism. Many campaigns for charity, humanitarian aid, and social awareness are organized online with great success. These activities reflect Islamic values of generosity, unity, and responsibility. At the same time, Muslims are reminded that the benefits of social media can only be achieved if it is used wisely and in harmony with Islamic ethics. In conclusion, social media is an effective tool for spreading Islamic values and awareness in today's world. Used responsibly, it can enhance da'wah, education, and unity, while helping Muslims protect their faith and contribute positively to the wider society.

Keywords: Social media, Islamic values, Awareness

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Seerah and Human Rights, Exploring the Life, Teachings and Legacy of the Prophet Muhammad (PBUH)

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This paper explores the profound connection between *Seerah*—the life and biography of the Prophet Muhammad (peace be upon him)—and the foundational principles of human rights. By delving into key events, teachings, and ethical practices from the Prophet's life, the study highlights how his example laid down universal values that align closely with modern human rights concepts, such as justice, equality, freedom of belief, dignity, and protection of the oppressed. Far from being a set of abstract ideals, these rights were actively implemented by the Prophet in his governance, social reforms, and personal conduct. Through analysis of primary Islamic sources including the Qur'an and authentic Hadith, this study demonstrates how the Prophet's treatment of women, children, minorities, slaves, and even enemies established a moral and legal framework that prioritized human dignity and justice. The Prophet's Farewell Sermon, for instance, is examined as a seminal declaration of human equality and rights, centuries before such ideas emerged in the Western world. Additionally, the paper addresses the relevance of Seerah in contemporary discussions on human rights, emphasizing the enduring legacy of the Prophet as a model of ethical leadership and social justice. In an age marked by global human rights challenges, the Seerah offers a comprehensive paradigm for addressing injustice through compassion, wisdom, and principled action. This study contributes to a deeper understanding of Islamic ethics and encourages a re-examination of Prophet Muhammad's legacy in shaping a just and humane society.

Keywords: Prophet Muhammad S.A.W, Human rights, Social justice, Islamic ethics, equality

The Role of Social Media in the Development of Contemporary Islamic Society: Opportunities and Challenges

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In the digital age, social media has emerged as a transformative tool shaping societies across the globe, including the Islamic world. This study explores the multifaceted role of social media in promoting the growth and development of Islamic society, focusing on its influence on religious awareness, community engagement and socio-cultural transformation. Platforms such as Facebook, YouTube, X (formerly Twitter) and Instagram have become dynamic arenas for disseminating Islamic teachings, fostering dialogue among Muslims, and connecting scholars with global audiences. The research highlights how social media enables the revival of Islamic values, da'wah activities, and intellectual discourse, while also examining the ethical and moral challenges it poses such as misinformation, cultural dilution, and misuse of religious content. Using a qualitative analytical approach, this paper assesses both the positive and negative dimensions of social media's impact on Muslim identity, unity and education. The findings indicate that when used responsibly and guided by Islamic ethics, social media can serve as a powerful instrument for spiritual revival, knowledge dissemination, and social reform. Thus, understanding and strategically employing these digital platforms is essential for fostering a balanced, informed, and value-driven Islamic society in the modern era.

Keywords: Social media, Islamic ethics, Da'wah, Digital communication, Religious awareness

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Measuring Progress: A Comparative Evaluation of Gender-based Violence Reduction Strategies in Pakistan and South Korea (2020–2025)

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This study evaluates the effectiveness of programs aimed at lowering gender-based violence in Pakistan and South Korea from 2020–2025. It evaluates cultural changes, legislative successes, and institutional responses aimed at reducing the incidence of Gender Based Violence (GBV) and promoting gender equality. National reports, international indices, NGO documents, and legislative forms all are used in the study. South Korea has shown efficacy through reinforcement actions, public awareness initiatives and survivor-oriented support networks, while Pakistan has challenges due to low reporting rates, cultural stigmas, and inadequate institutional coordination. The study focuses on how community engagement, socio-cultural variables, and government quality impact results in both situations. Finally, the report offers evidence-based suggestions for improving accountability, fostering global learning, and strengthening victim protection. By analyzing these two different socio-legal contexts, the study advances our knowledge of how contextualized methods may successfully lower GBV and advance long-term gender justice.

Keywords: Gender-based violence, Policy evaluation, Legal reforms, Victim protection, Gender justice

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Development of a Secure Image Encryption Algorithm Inspired by Chaotic Fluid Flow Dynamics

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In recent years, numerous chaos-based algorithms have been constituted for image encryption. However, none have utilized complex chaotic fluid flow systems. This study proposes a proficient image encryption scheme based on such a system, which is governed by a system of two nonlinear partial differential equations (PDEs). This system possess a strong chaotic behavior and complex dynamic making them appropriate for cybersecurity applications such as secure encryption and data protection. There are two crucial steps are involved in the proposed approach: First, the chaotic fluid flow system generates a pseudo-random sequence. This sequence then permuted to create extremely nonlinear chaotic maps. The resulting mappings demonstrate enhanced cryptographic properties ideal for secure image encryption.

Keywords: Encryption, Cybersecurity, Cryptographic

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Multimodal Deep Learning Approaches for Human Activity Recognition

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Smart home systems that recognize and monitor human activity can be particularly beneficial for older adults with care needs, assisting with tasks, monitoring emergencies, and providing companionship. However, privacy concerns remain a significant challenge in developing such systems. This talk will explore how multimodal deep learning approaches can enhance activity recognition while minimizing the collection of personal data. By evaluating sensors from a privacy perspective, integrating multiple sensor modalities, and leveraging advanced deep learning techniques, it is possible to achieve high accuracy while preserving privacy. The discussion will also highlight how these technologies contribute to smart home systems that support healthcare personnel and caregivers by providing real-time activity insights and detecting abnormal behaviors.

Keywords: Explainable AI, Human activity recognition, Sleep Apnea, Multimodality, Computer Vision

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New developments in Fuzzy Soft Graphs with Application in Manufacturing Industries

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In recent years, the concept of domination has emerged as a cornerstone of research in graph theory due to its wide-ranging theoretical significance and practical applications, including social network analysis, radio communication, commuter train transportation, geodetic measurements, internet-based transportation systems, pharmaceutical sciences, multi-attribute decision-making, patrolling transportation networks, and the installation of cellphone towers. Complementing this, the framework of fuzzy soft set theory, which integrates fuzzy sets and soft sets, provides a parameterized approach to managing uncertainty and vagueness in graph theory, thereby extending the applicability of domination-related concepts to decision-making problems, neural networks, and other domains. This paper aims to generalize the notions of bondage set, non-bondage set, bondage number, and non-bondage number within the context of fuzzy soft graphs by introducing a new definition of strong arcs to establish a connection with the strength of connectivity. The proposed concepts are formally presented and illustrated with examples, and several related results are established. Finally, potential application in manufacturing industries are discussed, highlighting the contribution of this research toward improving everyday life.

Keywords: Bondage and non bondage sets, Bondage numbers, Non bondage numbers

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Entrepreneurship Education: From Students to Innovators and Job Creators

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Entrepreneurship education has become a cornerstone of modern higher education, equipping young people with the knowledge, skills and mindset to turn ideas into opportunities. Around the world, universities are being called not only to prepare students to seek jobs, but to empower them to create them. This keynote explores the key factors influencing students' entrepreneurial intentions, drawing insights from the literature. Evidence shows that supportive university ecosystems—mentorship, incubators, and networks—play the most powerful role in fostering entrepreneurial motivation. At the same time, experiential curricula and applied learning approaches significantly enhance students' readiness, while gaps in lecturer competency highlight the need for more practice-oriented pedagogy. Importantly, there is no universal model of entrepreneurship education; strategies must be adapted to cultural and institutional contexts. By reimagining curricula, strengthening ecosystems, and promoting inclusivity, universities can cultivate entrepreneurial mindsets that enable young people to become innovators, job creators, and drivers of sustainable growth.

Keywords: Entrepreneurship education, Entrepreneurial intention, University ecosystems, Experiential learning, Innovation and growth

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Cultural Relevance and Innovation: Building Sustainable Marketing

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In the competitive business environment, sustainability and innovation are essential for securing sustainable competitive advantages. As environmental issues grow continuously, businesses are rapidly integrating sustainability into their strategies, with marketing innovations functioning as the foundation for this transformation. Sustainability has emerged as a differentiation factor, encouraging businesses to adopt innovative practices that meet environmental and societal standards. With the integration of sustainability into business functions, firms are required to rethink their marketing strategies. It includes emphasizing green marketing and ecological innovation to attract environmentally conscious customers. Cultural differences are essential for businesses in effectively communicating sustainability initiatives and products. Marketing strategies should extend beyond simple product differentiation and must align with local values, beliefs, and practices to effectively build consumer engagement. In some cultures, sustainability could be associated with traditional practices such as reducing garbage and conservation of ecosystems, but in other cultures, it might emphasize advanced technologies or innovative eco-friendly lifestyles. Marketing innovation acts not just as a mechanism for promoting sustainable products but also as an innovative strategy that redefines value creation across today's corporate context. This involves moving beyond traditional approaches and adopting a consumer-centric model. Businesses must integrate cultural sensitivity into product innovation to design marketing strategies. Such as, personalizing products and marketing messages to align with the social and environmental values of various cultural groups may boost consumer trust, loyalty, and engagement for businesses. Businesses can develop a sustainable marketing framework that addresses local customer needs while planning for future sustainability. Key concepts in sustainable marketing innovation involve cultural sensitivity and localization, societal awareness, consumer engagement and co-creation, technological advancements in sustainability, social responsibility, and brand purpose. Incorporating such concepts enables businesses to develop eco-friendly solutions that appeal to environmentally conscious consumers while generating business value.

Keywords: Cultural sensitivity, Consumer engagement, Green marketing strategies

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Socially Responsible Leadership and Green Investment as Drivers of Voluntary Employee Green Behaviour

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Amid growing global pressures for sustainable development and corporate environmental accountability, this study examines how internal organizational mechanisms (particularly human resource systems and leadership) foster pro-environmental employee behaviour. Drawing on green transformational leadership theory and resource orchestration theory, the research integrates these perspectives into an HRM–sustainability framework to explain how general human resource management (GHRM) practices evolve into socially responsible human resource management (SRHRM) through the influence of socially responsible leadership (SRL). Using data collected from manufacturing organizations in Pakistan, the study tests a model in which SRL strengthens the relationship between GHRM and key SRHRM dimensions, including legal compliance, employee orientation and CSR facilitation. Results reveal that SRHRM significantly enhances voluntary employee green behaviour (VEGB) through the mediating role of employee green work engagement (EGWE). Moreover, serial mediation pathways from GHRM to VEGB via SRHRM and EGWE are confirmed, while green investment is found to positively moderate these relationships. The findings advance theoretical integration between HRM and sustainability research, emphasizing the pivotal role of leadership and engagement in promoting environmentally responsible behaviours. Practically, the study offers actionable insights for managers and policymakers aiming to align HR systems with sustainability objectives and strengthen organizational environmental performance, particularly within developing country contexts.

Keywords: Socially responsible leadership, Green investment, Voluntary employee, Green behaviour

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Impact of Special Savings Certificates on the GDP of Pakistan

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The National Savings Organization is a financial institution in Pakistan. Since the 20th century, it has played a significant role in mobilizing domestic savings via various financial instruments, particularly National Savings Schemes (NSS). The National Savings Organization was established to promote frugality and promote low-risk investment opportunities. Special Saving Certificates (SSCs) are a key tool used by the Government of Pakistan to fund budgetary needs and spurs economic growth. Even through the enduring use of SSCs in Pakistan's financial system, empirical evidence on their actual impact on macroeconomic indicators like GDP remains limited. There is a noticeable gap in quantifying the extent to which SSCs influence national economic performance, as compared to other financial drivers like Gross Domestic Savings (GDS) and Gross Capital Formation (GCF). The main objective of this study is to examine the relationship between SSCs and GDP of Pakistan. This study employs a quantitative analytical approach on secondary data from the State Bank of Pakistan, the World Bank and relevant academic or official National Savings Organization literature on GDP, SSCs, GDS and GCF in the period of 1990-2024. The study confirms that SSCs have a positive role in Pakistan's economic output and highlights the importance of domestic savings on economic growth. The result elaborates that SSCs have a significant and positive effect on GDP.

Keywords: National savings schemes, Special saving certificates, GDP, Pakistan

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Health Promoting Leadership and Workplace Well-Being: The Role of Thriving and Psychological Capital

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With the growing emphasis on workplace well-being, organizations are increasingly adopting leadership approaches that integrate health-promoting initiatives into traditional leadership styles. Health-promoting leaders actively safeguard, enhance and restore the health and well-being of employees by fostering supportive and healthy work environments. Although existing literature has explored the effects of managerial coaching, job crafting and ethical leadership on employee well-being, the impact of health-promoting leadership remains largely underexplored. This study addresses this gap by investigating the influence of health-promoting leadership on the workplace well-being of employees within the service sector of Pakistan. Drawing on the Job Demands-Resources (JD-R) model, the study conceptualizes health-promoting leadership as a key organizational resource that enables employees to cope with demands while building personal resources. Using time-lagged (three waves) data collected from service sector employees, the study employs structural equation modeling (SEM) to test direct and indirect effects. In particular, the research examines the sequential mediation of psychological capital and thriving in the link between health-promoting leadership and workplace well-being. This sequential mechanism offers a novel contribution by highlighting how leadership not only directly influences well-being but also indirectly strengthens employees' psychological resources and thriving at work, thereby enhancing overall well-being. The study's findings provide valuable insights for policymakers and organizational leaders in Pakistan's service sector. By understanding the mechanisms through which health-promoting leadership fosters well-being, organizations can design and implement evidence-based initiatives more effectively. Ultimately, this research advances leadership and well-being literature, while offering practical insights for creating healthier workplaces.

Keywords: Health-promoting leadership, Workplace well-being, Psychological capital, Thriving, Job-Demands resource model

When Leaders Take Advantage: How Exploitative Leaders Drive Ostracism and Withdrawal in Political Climates

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Exploitative leadership, characterized by leaders' pursuit of self-interest at the expense of subordinates, has emerged as a critical dark-side leadership style with damaging implications for employees and organizations. Drawing on Conservation of Resources (COR) theory, this study develops and tests a moderated mediation model to explain how and when exploitative leadership fosters employee withdrawal. The purpose of the study is to uncover the underlying process through which exploitative leadership drains employees' psychological and social resources, thereby leading to perceptions of ostracism. Feeling ostracized signals both resource depletion and relational devaluation, which in turn motivates employees to engage in work withdrawal behaviors such as lateness, absenteeism and reduced effort as coping responses aimed at conserving remaining resources. Data were collected through a time-lagged survey design from full-time employees across multiple organizations and structural equation modeling was employed to test the hypothesized relationships. The results demonstrate that employee ostracism mediates the relationship between exploitative leadership and work withdrawal and that perceptions of organizational politics significantly moderate both the direct and indirect effects, such that the negative influence of exploitative leadership is stronger in highly political organizational environments. These findings offer several contributions: theoretically, the study extends COR theory by illustrating how exploitative leadership initiates a spiral of resource loss that culminates in withdrawal behaviors, while also identifying organizational politics as a contextual factor that exacerbates this resource depletion process; practically, the results highlight the need for organizations to curb exploitative leadership behaviors and reduce political climates, as both amplify employee exclusion and withdrawal.

Keywords: Exploitative leadership, Employee ostracism, Work withdrawal behavior, Perceptions of organizational politics.

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Project Management Strategies and Complexity as Determinants of Project Success

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Project success continues to be a central concern for organizations operating in complex and uncertain environments. This study examines how project management strategies and project complexity interact as determinants of project success. The unit of analysis is the individual project, which allows for a direct assessment of management practices, complexity dimensions and performance outcomes. A cross-sectional survey of 150 projects from industries including information technology, construction and healthcare was conducted. Respondents include project managers and senior team members who provided data on management strategies (traditional, agile and hybrid), levels of project complexity (structural, technical and socio-political) and project performance (time, cost, scope, stakeholder satisfaction and long-term organizational value). Multiple regression analysis was employed to test the hypothesized relationships. The results indicate that project management strategy is a significant predictor of project success. Hybrid strategies, which integrate agile flexibility with traditional planning, were associated with superior outcomes compared to strictly traditional approaches. Project complexity exerted a negative effect on success, suggesting that higher complexity reduces the probability of achieving desired results. Furthermore, interaction analysis demonstrated that strategy moderates the impact of complexity: in highly complex projects, adaptive and hybrid strategies mitigated much of the negative influence of complexity. These findings highlight that project success is not merely determined by resources but by the alignment between strategy and complexity. Traditional approaches perform adequately in low to moderate complexity contexts, while complex projects benefit from adaptive and hybrid methods emphasizing flexibility, iterative learning and stakeholder collaboration. The study contributes to theory by integrating project complexity with strategic management perspectives and to practice by underscoring the importance of early complexity diagnosis and tailored strategy selection.

Keywords: Project management strategies, Project complexity, Project success, Hybrid approaches, Regression analysis

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China's Rise and the United States' Relative Decline: A Geostrategic Analysis of Shifts in World Power

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In the late 1940s, the American-led liberal international order steered global relations and facilitated cooperation among states based on the principles of freedom, equality, free trade and liberal democracy. Currently, this order is facing the greatest challenge of its history from a rising power like China, despite the "end of history" claim by Francis Fukuyama. In this context, the study aims to explore the prospect of a shift in world power due to the relative decline of U.S. power and the rise of China. A qualitative research methodology was adopted, employing a comparative case study approach, where primary data, such as interviews with experts and secondary data, such as books and journals, were used to gather information. The study was guided by power transition theory, which explains the potential for conflict and power shifts due to a war between a rising and an established power. The results indicated that China's power is rising because of initiatives like the Belt and Road Initiative, the Global Security Initiative and the Global Civilization Initiative, while U.S. power is in relative decline but still holds significant structural advantages. In conclusion, the international system is experiencing a shift towards soft bipolarity rather than a replacement of U.S. hegemony. The study recommends constructive dialogue between China and the U.S. to minimize the chances of conflict and the U.S. should not hinder China, as its influence is increasing rapidly.

Keywords: China, United States, World Power, Geo-strategic

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Exploring The Role of Artificial Intelligence in Advancing Circular Economy and Sustainability in Pakistan's Health and Food Sectors

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As Pakistan grapples with environmental degradation, food insecurity and healthcare challenges, integrating sustainable development principles through a circular economy has become imperative. Artificial Intelligence (AI) offers transformative potential to drive this transition by optimizing resource use, minimizing waste and enhancing efficiency across critical sectors. This review explores the current and potential applications of AI in promoting sustainability and circular economy models within Pakistan's health and food sectors. In the health sector, AI-powered tools such as predictive analytics, intelligent diagnostics and supply chain optimization are assessed for their roles in reducing medical waste, improving service delivery and lowering carbon footprints. Similarly, in the food sector, AI applications in precision agriculture, smart logistics and food waste monitoring are reviewed to highlight their contributions to sustainable food systems. The paper critically examines the challenges hindering AI adoption in Pakistan, including data limitations, lack of infrastructure, policy gaps and ethical concerns. It also outlines strategic pathways for leveraging AI technologies in support of national sustainability goals and the UN Sustainable Development Goals. By synthesizing global and local perspectives, this review underscores the need for cross-sectoral collaboration, robust governance and investment in AI innovation to catalyse a resilient, inclusive and circular future for Pakistan.

Keywords: Artificial intelligence, Sustainability, Supply Chain, Carbon footprints

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Digital Adoption, Family Firms and Regulatory Barriers: Turning Constraints into Drivers of Circular Economy Practices

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This study investigates how digital adoption, family ownership and regulatory barriers influence the adoption of circular economy (CE) practices among European SMEs. Drawing on data from over 10,000 firms across 26 countries (Flash Eurobarometer 486, 2020), it integrates the Resource-Based View (RBV), Socioemotional Wealth (SEW) theory and Institutional Theory to explain how technology, tradition and regulation interact in driving sustainability. Empirical results from ordered logistic regression models reveal that digital adoption (particularly the Internet of Things) significantly enhances CE engagement, supporting the notion that digital capabilities serve as dynamic resources for environmental transformation. Family firms demonstrate higher CE adoption, consistent with SEW theory, though their advantage is contingent on digitalization. Moreover, regulatory barriers, typically viewed as constraints, emerge as catalysts for CE practices when coupled with digital capabilities and family ownership, aligning with the Porter Hypothesis on regulation-induced innovation. These findings collectively show that barriers can function as institutional enablers when mediated by internal resources and ownership logics. The study extends RBV by demonstrating how digital technologies foster CE-oriented capabilities, advances SEW theory by linking socioemotional motives with technological readiness and reframes Institutional Theory by highlighting the enabling potential of regulation. Practically, the results underscore that SMEs (particularly family firms) can enhance sustainability performance by aligning tradition with digital transformation, while policymakers should design regulations that stimulate innovation and digital integration rather than merely enforce compliance.

Keywords: Circular economy, Digital transformation, Family ownership, Regulatory barriers, Sustainability

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Managing the Transition to a Diversified and Sustainable Agricultural Enterprise

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The imperative for sustainable agriculture demands innovative approaches that reconcile ecological resilience with economic viability. Crop diversification stands out as a transformative strategy, capable of enhancing soil health, mitigating climate risks and opening new entrepreneurial pathways. However, transitioning from conventional monoculture systems to diversified operations involves significant complexity, uncertainty and strategic decision-making. This study introduces a structured project management framework designed to systematically navigate this transition, ensuring that sustainability goals are aligned with operational and entrepreneurial success. This framework empowers farmer entrepreneurs to treat diversification not as a mere agronomic shift but as a strategically managed enterprise project. Crop diversification represents a pivotal strategy within sustainable agriculture, aimed at enhancing ecosystem resilience, improving soil health and mitigating economic and climatic risks. This explores the integral role of crop diversification in modern agricultural systems and its potential to foster both ecological sustainability and financial viability. By moving beyond monoculture paradigms, diversification through the introduction of varied crop species, intercropping and rotation systems contributes to natural pest management, nutrient cycling and reduced dependency on external inputs such as fertilizers and pesticides. Farmers can leverage alternative crops to tap into growing consumer demand for locally sourced, organic and unique produce, thereby strengthening rural economies and enhancing food security. However, successful implementation requires careful planning, resource management and adaptation to local agroecological conditions. This study emphasizes the importance of integrating traditional knowledge with innovative practices and technologies to optimize diversification efforts. It also highlights the need for supportive policies, research and extension services to facilitate this transition. By embracing crop diversification, agricultural systems can become more adaptable, productive and sustainable, ensuring long-term resilience in the face of environmental and market uncertainties.

Keywords: Resilience, Climate adaptations, Sustainable agriculture, Entrepreneurship

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Enhancing Employee Innovation through AI Digital Skills, Knowledge Integration and E-Leadership

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This study examines the role of AI digital skills in fostering employee innovative behavior, emphasizing the mechanisms that enable digital competencies to translate into innovation. Grounded in Dynamic Capabilities Theory and Social Exchange Theory, the research proposes a moderated mediation model where digital knowledge integration acts as a mediator and e-leadership support serves as a moderator. Data collected from employees in technology-driven organizations were analyzed using structural equation modeling. Results demonstrate that AI digital skills positively influence innovative behavior through digital knowledge integration, while supportive e-leadership strengthens these relationships by encouraging employees to apply their skills effectively. The findings suggest that AI-related digital skills alone are insufficient to drive innovation; instead, their impact depends on the integration of knowledge and leadership practices in digital contexts. The study contributes to theory by linking micro-foundations of dynamic capabilities to innovation and offers practical implications for managers seeking to enhance innovation through skill development, knowledge integration and e-leadership practices.

Keywords: AI digital skills, Digital knowledge Iintegration, E-leadership, Innovative behavior, Dynamic capabilities

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Influence of Sustainable Marketing on Repeat Purchase Behavior

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This study investigates the impact of sustainable marketing initiatives (SMIs) on consumers' repeat purchase behavior (RPB), focusing on the mediating role of brand trust (BT) and the moderating influence of consumer environmental consciousness (CE). As sustainability increasingly shapes market dynamics and consumer expectations, SMIs have emerged as both a corporate responsibility and a strategic differentiator. Drawing on the Theory of Planned Behavior (TPB), the research explores the mechanisms through which sustainability-driven marketing efforts translate into repeat purchases. The findings reveal that SMIs significantly enhance RPB through the mediating effect of BT. Brand trust serves as a crucial psychological link that converts sustainable marketing actions into behavioral loyalty, as consumers are more likely to repurchase from brands they perceive as dependable and socially responsible. Furthermore, CE moderates this relationship, strengthening the influence of SMIs and BT among consumers who are highly aware of and motivated by environmental issues, while weakening it among those with lower environmental concern. The study contributes to the literature by integrating sustainability and consumer behavior perspectives to clarify how ethical marketing practices build long-term customer relationships. Practically, the results suggest that marketers should not only implement authentic sustainability initiatives but also align them with the values of environmentally conscious consumers to enhance brand trust, foster loyalty and ensure repeat purchase behavior.

Keywords: Sustainable marketing initiatives, Repeat purchase behavior, Brand trust, Consumer environmental consciousness

Bridging Policy and Implementation: Strengthening Anti-Encroachment Strategies for Urban Sustainability in Punjab, Pakistan

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Urban encroachment poses a critical challenge to sustainable urban development in Punjab, Pakistan. The issue has been exacerbated by rapid urbanization, weak enforcement of land-use regulations, inadequate institutional capacity and political interference, resulting in the illegal occupation of public spaces, green belts and infrastructure corridors. Existing anti-encroachment efforts largely emphasize reactive demolition rather than addressing the structural causes such as housing shortages, unclear property rights and governance gaps. This study evaluates the effectiveness of current anti-encroachment strategies across six key dimensions: reactive demolition approaches, policy framework, weak property rights and land record systems, community awareness and institutional capacity. Adopting a mixed-methods approach, data were collected through semi-structured interviews and structured questionnaires involving stakeholders such as local residents, business owners, government officials and urban planners. The findings reveal significant discrepancies between policy intent and on-ground implementation, highlighting deficiencies in institutional coordination, policy clarity and citizen engagement. By integrating policy analysis with empirical insights, the study identifies pathways for more inclusive and sustainable anti-encroachment measures. The recommendations emphasize participatory governance, transparent land management and community-driven awareness initiatives. The research directly supports the objectives of SDG 11 (Sustainable Cities and Communities by promoting equitable, resilient, and inclusive urban policies). Its outcomes provide valuable implications for policymakers, planners and civil society organizations seeking to align anti-encroachment efforts with the broader vision of sustainable urban governance in Punjab.

Keyword: Anti-Encroachment, Reactive demolition approach, Land-use regulations

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The Fintech Revolution: Redefining Post-COVID Banking Work and Customer Experience

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The COVID-19 pandemic accelerated the digital transformation of the banking industry, highlighting the critical role of financial technology (Fintech) in enhancing resilience, operational efficiency and customer satisfaction. Fintech, positioned at the intersection of technology and financial services, has reshaped how banks operate and engage with consumers. This study examines the impact of key fintech technologies (digital financial services, artificial intelligence, machine learning, cybersecurity, remote work systems and data analytics) on post-pandemic banking resilience. Using a mixed-methods approach combining structured questionnaires and interviews, data were collected from banking professionals and customers to assess the relationship between fintech adoption, operational performance and consumer outcomes. The findings reveal that fintech adoption significantly enhances banking resilience by improving digital infrastructure, reducing operational costs and supporting remote work efficiency. Furthermore, these advancements contribute to higher consumer satisfaction through improved accessibility, security, transparency and financial inclusion. The results also demonstrate that fintech-driven innovations empower consumers to make more informed financial decisions while strengthening trust and engagement with banking services. The study underscores fintech's transformative role in fostering a customer-centric, adaptive and sustainable banking ecosystem. The findings provide valuable insights for financial institutions and policymakers aiming to leverage technology for long-term digital resilience and enhanced service delivery in the post-pandemic era.

Keywords: Remote services, Digital transformation, Financial technology, Fintech adoption, Customer satisfaction

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The Power of Supportive Leadership: How Work-Family Enrichment Fuels Employee Success

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Based on the assumptions of Social Exchange Theory, this study explores that how supportive leadership that is family supportive supervisor behavior improves employees' success through work family enrichment. Specifically, the current study looked at how work family enrichment plays a mediating role between family supportive supervisor behaviors and employees' innovative work behavior. This study used deductive approach and closed ended questionnaires in two-wave time-lagged to collect the primary data. The data was obtained from 423 employees working in high pressure work sectors like healthcare sector and security sector of Pakistan by using the convenience sampling technique. SPSS software was used to test and analyze of gathered data. The results showed that work family enrichment played mediating role between the relationship of family supportive supervisor behaviors and employees' innovative work behavior, suggesting that employees who experience greater work family enrichment are more likely to thrive and innovate at work. The findings are valuable for organizations aiming to improve the employees as well as organization success through innovative and engaged workforce, especially in high pressure work sectors like healthcare and security sectors.

Keywords: Family supportive supervisor behaviors, Innovative work behavior, Social exchange theory

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Women, Myths and Misinformation: Understanding Gendered Vaccine Hesitancy in Conservative Societies

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Vaccine hesitancy remains a global health challenge, particularly in conservative societies where cultural norms, gender roles and misinformation shape women's health-seeking behaviors. Women often face patriarchal restrictions, limited access to reliable health information and cultural myths that disproportionately influence vaccination decisions. This systematic review aimed to synthesize evidence on how gendered cultural beliefs, misinformation and structural inequalities contribute to women's vaccine hesitancy, with a focus on South Asia and the Muslim world. A systematic search of peer-reviewed and grey literature was conducted in databases including PubMed, Scopus, Web of Science, and Google Scholar (2010–2024). Search terms combined "vaccine hesitancy," "gender," "women," "misinformation," "myths," "conservative societies," "South Asia," and "Muslim World." Inclusion criteria covered studies addressing women's vaccine attitudes and barriers in conservative cultural settings. Exclusion criteria included studies without gender-disaggregated analysis or outside the target regions. Data were extracted and thematically analyzed. Thirty-six studies met the inclusion criteria. Findings revealed that (1) women's vaccine decisions are strongly mediated by male family members and community elders, limiting autonomy; (2) misinformation linking vaccines to infertility, population control agendas, or haram ingredients circulates widely through social media, religious sermons and community networks; (3) low female literacy, exclusion from health decision-making and reproductive health taboos exacerbate misinformation susceptibility; and (4) gendered fears (especially concerning reproductive health) were consistently mobilized in vaccine-related myths, particularly during polio and COVID-19 campaigns. Studies highlighted that woman, while culturally positioned as guardians of family health, are also most constrained in accessing verified medical knowledge. Gendered vaccine hesitancy in conservative societies is reinforced by cultural narratives, religious interpretations and digital misinformation.

Keywords: Vaccine hesitancy, Gendered health, Cultural myths, Misinformation, South Asia

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National Business School
Poster Presentations

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Institutional Quality as a Conditional Factor in the Relationship between Green Investment and Corporate Performance in South Asia Economies

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The growing global emphasis on sustainability and environmental responsibility has positioned green investment as a vital component of corporate strategy. This study examines the impact of green investment on corporate performance across South Asian countries, focusing on how such initiatives enhance efficiency, innovation, competitiveness and stakeholder relations. Using secondary data from the World Bank, the analysis incorporates key indicators of institutional quality (voice and accountability, rule of law, political stability, government effectiveness, corruption control and regulatory quality) to assess how governance environments influence the effectiveness of green investments. The findings reveal that green investment significantly contributes to corporate performance, particularly in countries characterized by strong institutional frameworks. Conversely, weak governance conditions are found to hinder the realization of green investment benefits. By highlighting institutional variations across South Asia, the study deepens understanding of the interaction between governance quality and sustainable corporate practices. The results contribute to the growing body of knowledge on green finance and corporate performance and provide practical insights for managers and policymakers seeking to strengthen sustainability-driven corporate strategies in emerging economies.

Keywords: Institutional quality, Green investment, Corporate performance, South Asian economies

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An Empirical Study on The Moderating Role of Composite Governance Mechanisms between Accounting Conservatism and Financial Performance of Firms Audited by Big Four Auditors

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This study examines the impact of accounting conservatism on the financial performance of non-financial firms in Pakistan audited by Big Four auditors. Furthermore, it investigates the moderating impact of corporate governance between accounting conservatism and corporate financial performance relationship. This study used the accrual-based model proposed by Givoly and Hayn (2000) to quantify the accounting conservatism. The study creates composite corporate governance scores from eleven internal and external components using principal component analysis. It considers corporate financial performance as the dependent variable. It was derived from four financial indicators through principal component analysis. Regressoin analysis was used for the analysis of financial data of 102 non-financial firms over the period from 2012 to 2023. The outcome reveals the significant positive effect of conservatism accounting on the firm's financial performance. Furthermore, the governance mechanisms significantly strengthen the relationship between accounting conservatism and corporate financial performance as a moderating variable. The findings were supported by the stakeholder and resource dependency theories. The findings contribute to the literature on accounting conservatism, corporate governance and corporate financial performance in the context of an emerging economy like Pakistan. The study also offers valuable recommendations for policymakers, regulators, researchers, financial analysts, investors, creditors and auditors.

Keywords: Accounting conservatism, Corporate financial performance, Corporate Governance

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Financial Resilience and ESG Integration in Pakistan's Food Manufacturing Sector: A Comparative Analysis of Unilever Pakistan Foods Ltd. and Mitchell's Fruit Farms Ltd

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The growing emphasis on sustainable corporate governance has positioned financial resilience and ESG (environmental, social and governance) integration as central concerns for emerging economies. In Pakistan's food manufacturing sector, multinational corporations and domestic firms face distinct structural opportunities and constraints that influence their financial and sustainability trajectories. This study conducts a comparative, longitudinal analysis of Unilever Pakistan Foods Ltd. (UPFL) and Mitchell's Fruit Farms Ltd. (MFFL) over the period 2021–2024. Financial resilience is examined through profitability, liquidity, leverage, efficiency and shareholder return ratios, while ESG performance is assessed using established sustainability frameworks. A mixed approach of ratio analysis and qualitative evaluation enables a holistic understanding of corporate strategies. Results reveal divergent yet instructive paths. UPFL demonstrates consistent profitability, conservative leverage and stable dividend distributions, underpinned by multinational backing, efficient supply chains and standardized ESG protocols. MFFL, by contrast, faces volatility in early years, reflecting market and governance pressures. Nevertheless, by 2024, MFFL undergoes a financial turnaround characterized by strengthened margins, improved liquidity and progressive ESG adoption, underscoring the adaptive potential of local enterprises. The comparative analysis highlights the structural advantages of multinational firms in maintaining resilience, while also illustrating how domestic firms can strategically reorient and adopt ESG practices to restore competitiveness. By linking financial outcomes with sustainability integration, this study contributes to debates on corporate governance in developing economies and provides actionable insights for managers, investors and policymakers seeking to align financial stability with long-term sustainability.

Keywords: Financial Resilience, ESG integration, Food manufacturing, Corporate Governance, Pakistan

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Dark-Side of Generative AI Collaboration: Autonomy Loss and Creativity Decline

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This study investigates the dark-side of generative AI collaboration and its consequences for employee creativity. While AI tools can improve efficiency and streamline tasks, their rigid use may undermine employees' sense of autonomy, a critical resource for creative performance. Drawing on Conservation of Resources theory and Empowering Leadership theory, this research develops and tests a moderated mediation model in which perceived task autonomy mediates the relationship between AI collaboration and creativity and empowering leadership moderates these effects. Data from employees working in AI-intensive organizations were analyzed using structural equation modeling. Results show that dark-side AI collaboration reduces autonomy and, in turn, creativity. However, empowering leadership mitigates this negative impact by preserving discretion and encouraging employees to critically engage with AI outputs. Moreover, the positive effect of autonomy on creativity is amplified under high empowering leadership. The findings highlight both the risks and remedies of AI in the workplace and suggest that leadership practices play a vital role in sustaining creativity in AI-driven environments.

Keywords: Generative AI, Dark-side collaboration, Autonomy, Empowering leadership, Creativity

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The Psychology of Financial Well-Being: How Future Time Orientation and Overconfidence Shape Financial Outcomes

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This study investigates the impact of future time orientation (FTO) on financial well-being (FWB) among individual retail investors, examining the mediating role of overconfidence. Grounded in self-determination theory, the research integrates motivational and cognitive perspectives to explain how forward-looking orientations influence financial outcomes. Data were collected through a cross-sectional survey of 384 individual investors in Pakistan who invest in equities, mutual funds and other financial instruments, using a systematic sampling approach. Hypothesized relationships were tested using bootstrapping analysis. The results reveal that FTO has a significant positive effect on FWB, both directly and indirectly through overconfidence. Investors with a stronger future orientation tend to engage in more effective financial planning and demonstrate greater financial resilience. However, excessive overconfidence partially offsets these benefits by prompting riskier financial behaviors. These findings contribute to behavioral finance literature by uncovering a dual effect of overconfidence; acting both as an enabler and as a distortion in the FTO–FWB relationship. The study highlights the psychological underpinnings of retail investment behavior in emerging markets and provides practical implications for financial advisors, policymakers and educators. Promoting future-oriented financial attitudes while mitigating cognitive biases can enhance investors' sustainable financial well-being and decision-making quality.

Keywords: Financial well-being, Overconfidence, Future time orientation, Consumer financial protection

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Role of Perceived Value and Consumer Involvement in the Relationship between Advertisement Relevance and Purchase Intentions

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This study investigates the relationship between advertisement relevance and purchase intention by incorporating perceived value as a mediating variable and consumer involvement as a moderating factor. The research aims to clarify how relevant advertisements influence consumer purchase decisions and under what conditions this effect strengthens. Data were collected from online shoppers and analyzed using SPSS for descriptive statistics and SmartPLS for measurement and structural model assessment. The model tested both direct and indirect relationships, along with mediation and moderation effects. The results demonstrate that advertisement relevance significantly enhances purchase intention, with perceived value serving as a strong mediator between ad relevance and buying behavior. Moreover, consumer involvement positively moderates the relationship between advertisement relevance and perceived value, indicating that highly engaged consumers respond more favorably to relevant advertising content. Bootstrapping analysis further validated the strength and significance of the proposed relationships. The findings emphasize the importance of delivering targeted, meaningful advertisements that resonate with consumers' values and engagement levels. Businesses that enhance perceived value through relevant communication and appeal to involved consumers are more likely to achieve stronger purchase outcomes.

Keywords: Advertisement relevance, Purchase intentions, Perceived value, Consumer involvement

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Impact of Perceived Brand Ethics on Green Buying Behavior through Sustainable Practices

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This study examines the relationship between a brand's ethical image and consumers' intentions to purchase eco-friendly products. As environmental awareness grows, consumers increasingly favor brands that demonstrate honesty, fairness and social responsibility. Drawing on the Theory of Planned Behavior (TPB), the study investigates how perceived brand ethics influence green buying behavior through the mediating role of sustainability practices and the moderating effect of environmental concern. Data were collected from 200 apparel consumers in Faisalabad using a convenience sampling technique, and analyses were conducted through SmartPLS. The results reveal that perceived brand ethics significantly enhance green buying behavior, while sustainability practices serve as a strong mediator in this relationship. Furthermore, individuals with higher environmental concern show greater responsiveness to ethical and sustainable brand actions. Reliability and validity tests confirmed the robustness of the measurement model. These findings highlight that consumers reward brands that demonstrate genuine environmental responsibility through concrete actions such as eco-friendly packaging, waste reduction and clean energy use. The study contributes to the literature on ethical branding and sustainable consumption by integrating ethical perception and behavioral intention within a green marketing context. Practically, it emphasizes that consumers seek evidence of authenticity rather than symbolic claims; brands that align ethical values with tangible sustainability initiatives can build stronger trust and drive environmentally responsible purchasing decisions.

Keywords: Perceived brand ethics, Green buying behavior, Sustainability Practices, Environmental concerns

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Impact of Social Media Platforms on Brand Loyalty: Mediating Role of Perceived Value

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Social Media Platforms have become dynamic tools for marketing and customer engagement in the modern business environment. The purpose of this study is to examine the impact of social media platforms and perceived value on brand loyalty. It also explores whether perceived value mediates the relationship between social media platforms usage and the development of brand loyalty among consumers. The study aims to provide theoretical validation of the relationships between these variables and to identify their long-term implications for brand management. A structured questionnaire was used to collect responses from 200 social media users who are the followers of Facebook and Instagram. The data were analysed using both SPSS for demographic analysis and Smart PLS for Structural Equation Modelling. The results of the study indicate that the use of social media platforms has a significant and positive impact on brand loyalty. Moreover, perceived value plays a mediating role and significantly enhances the influence of social media platforms on brand loyalty. These findings contribute to the growing body of research on digital marketing strategies and provide valuable insights for businesses aiming to strengthen customer loyalty in a competitive digital environment.

Keywords: Social Media Platforms, Customer engagement, Brand loyalty, Perceived Value

Nutrition and Dietetics
Oral Presentations

Transforming the Pakistani Food System to Make it Healthy and Climate Resilient

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Despite advancements, Pakistan's hunger and nutrition situation remains poor; according to the 2024 Global Hunger Index, Pakistan ranks 109th out of 127 countries. It faces significant diversified poverty. Eighty-two percent of people cannot afford a nutritious diet, while food accounts for over half of the average household's monthly expenses. According to the national nutritional survey, Pakistan is suffering from a triple burden of malnutrition. Food insecurity due to an inadequate food system is one of the reasons behind this burden. Despite being an agricultural country, almost 37% of the population is food insecure. Agriculture is highly dependent on ecosystems, but in Pakistan, only 5% of the land is available for essential ecosystems that regulate water and climate, such as forests. In addition, deforestation, waterlogging, loss of soil fertility, wind and water erosion, and inappropriate livestock grazing have all contributed to the deterioration of available agricultural land. It is also ranked as the 8th most vulnerable country to climate shocks, such as floods, smog, and global warming, which have a high impact on food availability and affordability. The yields of wheat, rice, and fruit crops are further threatened by rising temperatures, unpredictable rainfall, water scarcity, and soil degradation, all of which also lower the nutritional value of these commodities. Increasing malnutrition, poverty, and vulnerability are interconnected issues that highlight the urgent need for a food system transformation in Pakistan to promote resilience and health. This transformation should be based on climate-smart approaches, such as drought- and salinity-resistant crops, as well as high-nutrient-value crops, such as biofortified ones. Efficient irrigation and regenerative agriculture are also ecosystem-based solutions that can improve food production and reduce post-harvest losses, which account for 40% of total losses in Pakistan. Dietary diversity is also one of the central issues in Asian countries like Pakistan, where most people depend on starchy foods, which leads to nutritional deficiencies. Working on food diversity motivates people to grow nutrient-rich crops, such as vegetables and Fruits. Their increased production will lead to increased consumption and improve nutrition security in Pakistan.

Keywords: Food system, Transformation, Climate-smart, Food insecurity

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Toward Precise, Predictive, and Personalized Nutrition: AI-Driven Diets for Health Optimization

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Personalized nutrition, a rapidly advancing paradigm in health and wellness, aims to optimize dietary recommendations by tailoring them to individual characteristics such as metabolic biomarkers, gut microbiome composition, genetics, health status, and lifestyle. This approach moves beyond the limitations of acknowledging inter-individual variability in nutrient metabolism, generalized dietary guidelines, dietary responses, and disease risk. Advances in artificial intelligence (AI) systems are revolutionizing the field of nutrition by enabling the integration of large-scale datasets with complex analyses of proteomics, metabolomics, and genomics, as well as real-time lifestyle tracking from wearable devices. Diets generated by AI-driven methods leverage predictive algorithms to monitor metabolic responses, generate adaptive meal plans, and provide dynamic feedback on those plans, supporting precision interventions for metabolic disorders, weight management, and chronic disease prevention. Furthermore, AI enables automated nutrient profiling, image-based food recognition, and behavior prediction, making personalized nutrition more accessible and scalable. At the same time, these technologies hold immense potential to promote sustainable dietary practices and improve health outcomes. The convergence of AI-driven dietary tools and personalized nutrition signals provides a transformative shift in nutrition science, paving the way for precision health strategies that are adaptive, preventive, precise, and individualized.

Keywords: Personalized nutrition, Artificial intelligence, Sustainable dietary practices, Automated nutrient profiling

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Digital Innovations in STEAM Education for Tackling Malnutrition and Food Insecurity

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The unification of Science, Technology, Engineering, Arts, and Mathematics (STEAM) into nutrition education has emerged as a transformative approach to addressing global challenges of malnutrition and food insecurity. There is an increased reliance on digital platforms and novel innovations such as mobile applications, gaming tools, and artificial intelligence. They are being used to increase nutrition awareness, promote behavioral change, and empower communities. This study examines the involvement of digital innovations within the STEAM framework to generate engaging, evidence-based strategies that address nutritional deficiencies and food access disparities. Digital tools facilitate interactive learning by combining scientific knowledge with artistic creativity, enabling learners to visualize nutrient functions and sustainable dietary practices. AI applications provide tailored dietary recommendations, while mobile platforms expand access to nutrition education in underprivileged regions. Case studies of digital nutrition interventions highlight the improvements in dietary knowledge and community engagement. Furthermore, these innovations support capacity building among educators, healthcare workers, and policymakers, fostering interdisciplinary collaborations to develop sustainable solutions. This research suggested that embedding digital innovations into STEAM-based nutrition education enhances problem-solving skills and encourages critical thinking. In conclusion, digital STEAM approaches offer a promising educational model for bridging the gap between nutrition science and real-world application. Hence, empowering individuals and communities to make healthier, more sustainable dietary choices. Incorporating creativity with technology ensures that learning is both impactful and culturally relevant.

Keywords: STEAM education, Digital innovations, Malnutrition, Food insecurity, Nutrition awareness

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Artificial Intelligence in Nutrition: Transforming Health through Smart Technologies

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Artificial Intelligence (AI) is rapidly transforming the field of nutrition, offering innovative solutions to address global health challenges, personalize dietary interventions, and enhance clinical nutrition practices. This paper explores the integration of AI technologies, including machine learning, natural language processing, and computer vision, into nutrition science and dietetics. AI-driven tools can now analyze vast datasets, predict disease risk based on dietary patterns, and deliver personalized nutrition plans tailored to individual genetic profiles, lifestyles, and health conditions. From smart apps that monitor food intake using image recognition to AI algorithms that assist healthcare professionals in diagnosing nutrient deficiencies and managing chronic conditions like diabetes and obesity, the applications are vast and impactful. Additionally, AI contributes to population health by enabling data-driven public health policies and optimizing food supply chains. Despite these advancements, challenges related to data privacy, algorithmic bias, and the need for interdisciplinary collaboration remain unclear. These findings highlight the transformative potential of AI in nutrition, advocating innovation that prioritizes equity, accuracy, and human oversight to improve global health outcomes.

Keywords: Machine learning, Dietary interventions, Diabetes, Artificial intelligence, Public health policies

From Plate to Psychology: A STEAM Perspective on Dietary Patterns and Mental Wellness

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In past years, there has been a surge in research on the effects of nutrition on mental health. This review aims to summarize the effects of different dietary elements, such as micro and macronutrient intake and habits, on brain health. Stress affects eating, exercise behaviors, and other stress-related psychiatric disorders, which include PTSD (post-traumatic stress disorder) and depression, and can also lead to changes in metabolism. Unhealthy eating can alter brain function. Stress also affects the neuropeptides, inflammatory markers, and neurotransmitters that are present in the gut and brain. Diet and its bioactive compounds possess antioxidant activities and act as anti-inflammatory agents (i.e, omega-3 fatty acids and polyphenols are beneficial for the CNS). Depression is a syndrome that is increasing at an alarming rate in the general population. It gradually increases the risk of multiple diseases. In some conditions, appetite decreases, while others respond with enhanced appetite in distress. An unhealthy diet, such as a diet with fewer vegetables and an excessive intake of saturated fats, is a major contributor to these psychiatric conditions. Vegetarian diets improve mental health and are low in protein, decreasing the risk of anxiety. GABA (gamma-aminobutyric acid) is the neurotransmitter that is linked to anxiety and depression. GABA is produced from glutamic acid by GAD (glutamic acid decarboxylase), which is influenced by protein intake. Evidence suggests that a high-protein, high-carbohydrate diet is related to anxiety and depression and deregulates the immune-inflammatory response. The results suggest that specific comfort foods are preferred by patients under stress.

Keywords: Mental Health, Stress, Depression, Anxiety, Healthy eating

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Nutritional Interventions for Maternal and Child Health: Challenges and Opportunities

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Maternal and Child Nutrition is a fundamental pillar of public health that directly influence the survival, growth and cognitive development which ensures long-term wellbeing of mother and child. Despite global efforts, malnutrition is still a major concern of maternal health that continues to affect millions of mothers and child health, particularly in underdeveloped regions of the world. This study explores the multifaceted challenges and emerging opportunities in designing and implementing various effective nutritional interventions across the maternal-child continuum. Key barriers in maternal-child nutrition include limited availability and accessibility of nutrient-dense foods, behavioral and cultural constraints, lack of nutrition education, and improper health system integration. In Pakistan, these challenges are majorly present because of poverty, men are dominant over women due to gender disparities, and fragmented service delivery. However, promising opportunities are emerging through community-based programs, nutrition education, fortified food initiatives, context-sensitive supplementation, and motivational-behavioral strategies.The integration of nutrition into antenatal care, promoting breastfeeding, educating mothers on complementary feeding, and implementing school-based interventions can create synergistic impacts on maternal-child health. Moreover, aligning interventions with Sustainable Development Goals (SDGs), especially those targeting zero hunger, good health, and gender equality, enhances policy relevance and funding potential. Highlights, evidence-based approaches, including culturally adapted meal planning, locally sourced fortified products, and participatory education models that empower women and caregivers. It also emphasizes the need for interdisciplinary collaboration among nutritionists, educators, policymakers, and community leaders to ensure sustainability and equity. By addressing systemic barriers and leveraging innovative tools, nutritional interventions can become more impactful, inclusive, and resilient, ultimately improving maternal and child health outcomes across diverse populations.

Keywords: Maternal-child health, Nutritional interventions, Challenges, Opportunities

Nutrition and Dietetics
Poster Presentations

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Shaping Healthy Futures: STEAM Integration in Youth-Centered Nutrition Projects

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The escalating global burden of diet-related diseases underscores the critical need for innovative nutritional education strategies that extend beyond traditional didactic methods. This paper examines the transformative potential of integrating Science, Technology, Engineering, Arts, and Mathematics (STEAM) into youth-centered nutrition projects to foster profound and lasting health literacy. STEAM provides a holistic framework where scientific inquiry into nutrients (Science), utilization of dietary apps and sensors (Technology), design of sustainable food systems (Engineering), data analysis of nutritional intake (Mathematics), and creative communication of health messages (Arts) converge. Current research, including studies indexed on Google Scholar, demonstrates that project-based STEAM initiatives significantly enhance youth engagement and knowledge retention. For instance, hands-on projects like designing hydroponic gardens or using spectral analysis to assess food quality. Furthermore, data from organizations like the CDC and WHO corroborate that participatory, youth-led programs empower adolescents to become agents of change within their communities, effectively translating personal learning into broader public health impact. This analysis argues that STEAM integration is uniquely positioned to address complex modern health challenges by cultivating critical thinking, systems reasoning, and creative problem-solving skills. By centering youth in the design and execution of these projects, educators can create culturally relevant and motivating learning experiences. The conclusion emphasizes that investing in interdisciplinary, STEAM-driven nutrition education is not merely an academic exercise but a vital public health strategy for equipping the next generation with the tools to make informed choices, thereby shaping a healthier future.

Keywords: STEAM integration, Nutrition education, Youth-centered projects, Health literacy, Project-bassed learning

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Functional Foods for Diabetes Management

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Diabetes has become a pandemic health problem, and new approaches for better management are required. The functional foods, which are defined as those that offer benefits beyond that of simple nutrition, are considered a good strategy for maintaining blood glucose control and general health in diabetic patients. The objective of this review is to describe the role of functional foods in the management of diabetes, underlining the possible role of functional foods in reducing disease complications. Functional foods, which possess a number of bioactive compounds that work in concert to improve insulin sensitivity and suppress postprandial blood glucose levels while reducing inflammation, include whole grains, legumes, nuts, seeds, and selected fruits and vegetables. For instance, the addition of soluble fiber, mainly from oats and barley, has been shown to lower postprandial glycemic responses and thus improve glycemic control. In addition, several reports have identified that active functional foods such as cinnamon and bitter melon improve glucose metabolism. Such foods, when incorporated into one's daily diet, could be holistic in managing diabetes and, hence, advocate dietary changes as complementary to conventional medical treatments. In short, functional foods signify a major leap forward in diabetes care due to the enormous multifaceted benefits. It offers to enable subjects to take responsibility for their health. Further research will identify and validate functional foods with potential health benefits, leading to personalized dietary recommendations.

Keywords: Functional foods, Diabetes management, Glycemic control, Insulin sensitivity, Dietary

Global Hunger and Health: A STEAM Powered Approach to Ending Nutritional Inequities

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Widespread disparities in global nutrition, evident in both inadequate and excessive nutrient intake, continue to endanger public health, particularly in lower- and middle-income nations. A significant portion of the global population experiences what is termed "hidden hunger," a state in which individuals consume enough calories but lack essential vitamins and minerals. It can severely impact physical development, immune resilience, and mental performance. The other issue is the rising trend of the "double burden" of malnutrition, where communities face both growth faltering due to nutrient shortages and increasing rates of obesity and chronic illnesses. This is especially common in areas undergoing rapid changes in economy, food systems, environment, and social structures. This includes enhancing the nutritional value of essential crops through biofortification, promoting more diverse and balanced eating patterns rich in fruits, vegetables, legumes, nuts, and reinforcing sustainable farming methods, streamlining food production and distribution systems to minimize waste and inefficiency, while also shaping inclusive policies that target deep-rooted social and economic disparities. A "STEAM-powered approach" driven by four interconnected forces: cutting-edge scientific inquiry and technological advancement; grassroots activism and community empowerment; fair policy development; and responsible management of natural and human resources. Working in unison, these elements form a strong, coordinated force capable of challenging and dismantling long-standing nutritional disparities. By combining proven, data-driven strategies with a strong commitment to equity and justice, this approach helps to eliminate hunger in all its dimensions and promote lasting health and well-being for vulnerable populations worldwide.

Keywords: Hidden hunger, Double burden, Biofortification, Economic disparities, Justice

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Gamified Nutrition: Using STEAM Tools to Teach Kids About Food

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Childhood is a crucial stage for developing lifelong eating habits, yet traditional nutrition education often fails to engage children in meaningful ways. This paper explores how gamification, integrated with STEAM (Science, Technology, Engineering, Arts, and Mathematics) tools, can provide an innovative and interactive approach to teaching kids about food and healthy choices. By leveraging digital platforms, interactive storytelling, and creative problem-solving tasks, gamified nutrition education transforms concepts such as food groups, portion sizes, and nutrient balance into tangible, playful experiences. For example, science modules can highlight digestion and metabolism, while technology enables augmented reality (AR) or app-based challenges. Engineering activities encourage hands-on projects, such as designing a balanced lunchbox, while arts-based storytelling reinforces cultural appreciation of food. Mathematical elements, such as calculating sugar content or comparing calorie intake, strengthen analytical skills alongside nutrition knowledge. The integration of these domains not only enhances engagement but also fosters critical thinking, creativity, and collaboration among children. Moreover, gamification through rewards, badges, and levels encourages sustained participation and motivates children to apply their knowledge in real-life dietary decisions. Preliminary research suggests that such approaches improve both knowledge retention and healthy behavioral intentions. This paper argues that gamified STEAM-based nutrition education is a powerful strategy for empowering children to make informed food choices enjoyably and holistically. Ultimately, it proposes a framework for educators and curriculum designers to incorporate play, technology, and interdisciplinary learning to promote healthier generations.

Keywords: STEAM, Nutrition Education, Metabolism, Digital platform

Food Waste Reduction Strategies: Innovative Business Models and Technological Solutions for a Sustainable Food System

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Food waste is a major problem that causes global food security challenges, economic and environmental instability. The following study explores innovative business model solutions that leverage technologies to overcome food waste across the supply chain, from production to consumption. The main objective of this study is to identify actions and policies that can be easily expanded and upgraded on demand as the economy changes, and to help facilitate the transition to a reliable and sustainable food system. A mixed-methods approach, combined with a systematic review of peer-reviewed literature, is applied to case studies of circular business operating models and food technology startups operating in Asia, Europe, and North America. The interviews with entrepreneurs, stakeholders, and policymakers who are involved in the supply chain were analyzed. The study's results highlight key innovation categories, including models of the sharing economy (e.g., a network of surplus food redistribution), blockchain in logistics, optimizing inventory management using digital platforms like AI, and using food byproducts to create value-added products. These revolutions have a significant impact and can reduce food waste by 40% at the retail and consumer levels, ultimately reducing greenhouse gas emissions that cause a rise in temperature and pollution. The study concludes that it is important to collaborate with stakeholders and implement policies that support investment in technology to scale the solutions previously mentioned. It further highlights the importance of consumer behavior change and emphasizes the need for data-driven decision-making for future interventions. It provides actionable insights for business, civil society, and governments, and focuses on building a sustainable and resilient food system.

Keywords: Food security, Food chain, Business model, Food technology

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Sustainable Food Systems in a Changing Climate: Leveraging STEAM Innovations for Climate Resilience

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The escalating effects of global warming are placing unprecedented pressure on global food systems. Rising temperatures, irregular rainfall, soil degradation, and declining water resources threaten both food security and food quality. Food production itself is also a major source of greenhouse gas emissions, underscoring the need for interventions that address both resilience and sustainability. A STEAM perspective offers a cohesive framework to confront these challenges. Advances in agroecology, soil conservation, and crop improvement are enabling the adoption of climate-resilient agricultural practices. Technological innovations such as precision irrigation, remote sensing, and improved storage facilities are optimizing resources and reducing waste across the supply chain. Engineering approaches, including controlled-environment agriculture and renewable energy integration, provide new ways to grow food in degraded ecosystems. Beyond science and technology, education and the arts foster awareness, encourage behavioral change, and integrate local and indigenous knowledge into sustainable practices. Mathematical modeling and scenario analysis further strengthen decision-making by identifying risks and testing adaptation strategies. Collectively, these interdisciplinary innovations present practical pathways to redefine food systems as productive, inclusive, and sustainable. By leveraging STEAM-based solutions, societies can build climate-resilient food systems that safeguard both human well-being and planetary health for future generations.

Keywords: Sustainable food systems, Climate resilience, Resource efficiency, Food security

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Optometry
Oral Presentations

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From Science to Society: Advancing Myopia Control through Technology and Education

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Myopia has emerged as one of the most significant public health challenges of the 21st century, with its prevalence rising rapidly among children and young adults worldwide. Although scientific advancements have introduced effective strategies to slow myopia progression, translating this knowledge into clinical practice and community awareness remains a critical challenge. This presentation summarizes and critically reviews the most recent research (from the past two years) on evidence-based advances in myopia control, including optical interventions such as orthokeratology, multifocal contact lenses, and specialized spectacle lenses, as well as pharmaceutical approaches like low-dose atropine. It also explores how artificial intelligence (AI) can be a powerful partner in addressing the myopia epidemic through enhancing early risk identification, predicting progression, and tailoring treatment plans to meet individual patient needs. Beyond technology, the session highlights the essential role of patient education and digital learning platforms in bridging the gap between scientific discovery and clinical application. It emphasizes the importance for eye care professionals to stay informed about global trends, leverage advanced monitoring techniques, and adopt evidence-based practices. By integrating innovation, data, and human-centered education, this approach empowers practitioners to deliver personalized, effective, and sustainable myopia management—ultimately connecting science with society to shape a clearer future for global vision health.

Keywords: Myopia control, Technological innovation, Personalized treatment, Evidence-based practice, Artificial intelligence

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Compare the Educational Environment and Prevalence of Myopia in Public and Private Schools

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A cross-sectional study was conducted from August to December 2024, implementing a stratified sampling technique. Two schools were chosen at random from each of the public and private school strata. From each grade level, students were then selected at random. Individuals with ocular problems (such as strabismus, amblyopia, hyperopia, systemic diseases, infections, or syndromes) or those who declined to participate were not included. Six hundred twenty-one students between the ages of 8 and 15 took part. Ocular examination included refraction and visual acuity. A self-structured questionnaire was utilized to assess the home and school educational environment variables. SPSS software was used for data analysis. Among 621 students (mean age 13 ± 1.89 years), 46.53% were male and 53.46% were female. Three hundred eighty-seven students attended public schools, while 234 attended private schools. Of the 210 students, 33.8% myopia, with 10% having high, 33.33% having moderate, and 56.66% having mild myopia. There were 109 myopes from private schools and 101 from public schools. It's interesting to note that 109 out of 234 students in private schools (46.58%) have myopia. Notable differences were found in the public and private sectors' educational environments. More artificial lighting, fewer outside activities, and a stronger focus on digital learning resources like laptops and tablets are features associated with private schools.

Keywords: Myopia, Risk factor, Mitigation, Educational environment, Prevalence, Classroom daylighting

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Axial Length Changes After Short-Term Exposure to Blue Light Among Emmetropes with Optically Induced Hyperopic Defocus

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The study aimed to measure the transient axial length (AXL) changes after short-term exposure to blue light before and after hyperopic defocus. An interventional study design (Quasi Experiment, Pre and Post Interventional design) was carried out at Al-Shifa Trust Eye Hospital among optometry students using a non-probability judgmental sampling technique. Visual acuity was measured with Log MAR, and refractive status was determined with Retinscope. Exposure to blue light was given from a blue Laser Pointer emitting 405 nm wavelength. Hyperopic defocus was induced using a -3.00DS lens in the trial frame. IOL Master Zeiss 700 was used to measure the AXL. Data were entered and analyzed using the Data tab in online web-based software. A total of 30 subjects, including 6 (20%) males and 24 (80%) females, with a mean age of 20.67 ± 0.96, were studied. Comparing Pre-defocus Axial Length (PDAXL) and After-defocus Axial Length (ADAXL) following 30 seconds (23.2 ± 0.69, 23.19 ± 0.68; p = 0.006), 60 seconds (23.2 ± 0.68, 23.2 ± 0.68; p = 0.056), and 90 seconds (23.2 ± 0.69, 23.2 ± 0.69; p = 0.002) of exposure to blue light, a statistically significant difference was observed in the 30-second and 90-second exposure groups (p = 0.006 and p = 0.002, respectively), but not in the 60-second group (p = 0.056). It was concluded that short-wavelength light exposure combined with hyperopic defocus induces axial length shortening, suggesting a potential mechanism for controlling myopia progression.

Keywords: Myopia, Axial length, Optical defocus, Blue light

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Prevalence and Predictors of Digital Eye Strain Among University Students: A Cross-Disciplinary Approach to Visual Wellness in the Digital Age

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The widespread use of digital devices has led to an increasing prevalence of Digital Eye Strain (DES), characterized by ocular discomfort, dryness, and visual fatigue. This study aimed to determine the prevalence and predictors of DES among university students and to propose interdisciplinary strategies for digital visual wellness. A cross-sectional study was conducted among 300 university students using a structured questionnaire and basic ocular assessments. DES symptoms were evaluated using the Computer Vision Syndrome Questionnaire (CVS-Q), alongside Schirmer's test and Tear Break-Up Time (TBUT) measurements. Statistical analysis was performed using SPSS v26 with Chi-square and logistic regression tests. The prevalence of DES was 68.3%, higher among females (72%) than males (62%). Prolonged screen time (>6 hours/day), inadequate breaks, poor lighting, and reduced blink rate were significant predictors (p < 0.05). Mean TBUT was 7.1 ± 2.8 seconds, and mean Schirmer's value was 12.4 ± 3.6 mm, indicating mild tear instability. Behavioral factors and screen habits showed a strong correlation with DES symptoms. Digital eye strain is highly prevalent among students, highlighting the need for interdisciplinary interventions combining optometric screening, ergonomic education, and behavioral modification.

Keywords: Digital eye strain, Computer vision syndrome, Optometry, Screen time

Effectiveness of Vision Pro Glasses for Low Vision

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Low vision is a condition affecting multiple lives globally, limiting daily activities. Vision Pro Smart glasses, equipped with a CCTV camera, ultrasonic sensors that generate ultrasonic waves, audio feedback, and adjustable frequency, use advanced technology to enhance the mobility and safety of visually impaired individuals. This study aimed to evaluate the effectiveness of Vision Pro Glasses for visually impaired individuals. The cross-sectional study was conducted from October 2024 to January 2025 at Al-Faisal Blind School, Faisalabad. The sample size was 30, including both males and females. The sampling technique used was non-probability convenience-based sampling. Data was analyzed using SPSS software. Registered low-vision individuals over 8 years old were included, while those with intellectual disabilities or hearing loss were excluded. Subjects used Vision Pro Glasses, and their mobility was tested with obstacles. Descriptive statistics and frequency distribution graphs were used to analyze data. The mean age was 38.8. The prevalence of low vision is 3.7-4%. Out of 30 individuals, 5 (16%) were females and 25 (83%) were males. About 3.3% were moderately visually impaired,10 (33.3%) was suffering from severe visual impairment, and 19 (16.3%) were in the category of profound blindness. The mean values of quantitative variables, including time taken indoors, were 5.983 min; time outdoors was 7.8333 min; number of obstacles contacted was 2.7000; and missed obstacles were 7.3000. Vision Pro Glasses proved to be effective in enhancing the orientation and mobility of people with low vision.

Keywords: Low vision, Smart glasses, Technology, Ultrasonic waves

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The Escalating Burden of Childhood Myopia in Punjab, Pakistan: Prevalence Among School-Aged Children (4-16 Years)

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The accelerated global prevalence of myopia presents a remarkable threat to long-term visual health, especially in school-aged children. This review article synthesized 40 distinct prevalence data points and findings from studies conducted in Punjab, Pakistan (2015–2025), specifically targeting children and adolescents aged 4 to 16 years. The data indicated a wide range in myopia prevalence, rising alarmingly from lower rates in rural areas to over 50% in urban and academically intensive regions such as Lahore and Faisalabad. Myopia consistently emerged as the most prevalent refractive error. The major risk factors identified across studies included excessive near work, prolonged exposure to electronic devices, and insufficient outdoor activity. These findings highlight the urgent need for targeted, province-level public health interventions and policy reforms within Punjab's education and health sectors to curb the escalating burden of childhood myopia. Early school-based vision screening programs and awareness campaigns could play a critical role in early detection and prevention.

Keywords: Myopia, Punjab, Electronic devices, Children

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Pharmacy
Oral Presentations

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Nano-enabled Drug Delivery Systems for Cardiovascular Therapeutics

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Nitric oxide (NO) is a powerful signalling molecule released by vascular endothelial cells that is essential for vascular health. Dysregulation of NO is a common feature in hypertension, angina, heart failure and in the response to vascular injury. For this reason, the exogenous administration of systemic NO donating formulations such as organic nitrates and nitrites has been a cornerstone for the treatment of cardiovascular diseases. These donors primarily produce NO in the circulation, are not targeted to specific vascular beds or cellular sites of action, and have common but debilitating adverse effects. Ideally, it would be possible to deliver the right amount of NO to a precise location at the right time. To achieve these aims, we have recently developed a suite of nanomaterial-based strategies to address this challenge. Porous graphene oxide nanosheets functionalised with cysteamine generate *S*-nitrosated carriers capable of sustained NO release at physiologically relevant rates, mimicking healthy endothelium, with selective effects to promote endothelial proliferation while inhibiting smooth muscle cell growth which was associated with release of cGMP indicating intracellular activation of canonical NO signalling. Building on this, pH-responsive dipeptide-graphene hybrids were engineered to store and release NO gas in a controlled manner, arresting burst release at neutral pH while enabling improved delivery under acidic conditions. In parallel, polymer-graphene catalysts were developed as bioresorbable stent coatings to catalyse the generation of NO from endogenous *S*-nitrosothiols, achieving prolonged and stable NO release under physiological conditions. Together, these findings demonstrate the versatility of graphene-based nanomaterials as NO delivery and generating platforms, offering targeted, controlled and durable NO bioactivity for the treatment of cardiovascular diseases.

Keywords: Angina, Hypertension, Vascular injury, NO delivery

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Innovations in Transdermal Drug Delivery

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Minimally invasive techniques like microneedle, Iontophoresis are intended to overcome the drawbacks associated with parenteral route and deliver medicaments transcutaneously into general circulation. During the recent years there has been an incremental effort exerted to document MN patch and iontophoresis mediated drug delivery. Drug loaded patches were prepared using polymers such as sodium alginate (SA), and polyvinyl pyrollidone (PVP etc. Patches were evaluated for morphology, folding endurance, swelling and insertion ability. In-vivo activity was assessed by recording different physiological parameters e.g., immunoglobulin G, interferon gamma, T-cell following patch application. Patches displaying sharp tips and uniform surface, showed a folding endurance and swelling of >=200 and around 70%, respectively confirms integrity and fluid uptake ability. Microappendages successfully penetrated into the skin simulant parafilm. A significant increase in the IgG, IFN-gamma, and T-cells confirms efficacy of formulations. Effects were significantly augumented in the presence of iontophoresis. It was concluded that, MN patches can be used for transcutaneous drug delivery.

Keywords: Iontophoresis; Microneedles; Transdermal drug delivery, Vaccine delivery

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Eco-Friendly Hydrogel Films Containing Natural Extracts for Enhanced Wound healing: A Sustainable Pharmaceutical approach

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Hydrogel membranes resemble biological tissues and currently there is a tremendous interest in their development as wound healing dressings. Alpha mangostin (α-MG), being a highly active xanthone is well recognized for its wound repair potential. However, because of its poor solubility and relatively brief retention time on cutaneous wound sites, its effectiveness on wounds is compromised. Herein, α-MG was incorporated in gellan gum (GG) based hydrogel membranes by solvent casting crosslinking technique, the resulting eco-friendly films demonstrated excellent antibacterial, antioxidant and anti-inflammatory effects. Physico-chemical evaluation confirmed optimal thickness, flexibility, homogeneity and swelling ability. The structural characterization was carried out using Fourier transform infrared spectroscopy (FTIR), X ray diffractometery (XRD) and scanning electron microscopy (SEM).In vivo, the films promoted re-epithelization and reduced the levels of pro inflammatory and apoptotic cytokines. Taken together, this novel hydrogel membranes containing alpha-mangostin support the development of sustainable pharmaceutical platform for enhanced cutaneous wound healing using natural bio actives.

Keywords: Gellan gum, α-mangostin, Wound healing, Hydrogel membranes, Antibacterial

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Purinergic Receptor P2x7 on Tumour Cells Potentiate the Cytotoxicity of Chemotherapeutic Drugs

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Cancer remains the one of the leading causes of morbidity and mortality worldwide and its treatment continues to represent a major challenge due to heterogenous patient response to the current therapies. The activation of immune system by immunogenic cell death (ICD) offers a promising approach to improved disease control. Certain chemotherapeutic agents such as doxorubicin (DOX) can elicit ICD by triggering the integrated stress response (ISR) pathway. This process is characterised by the translocation of calreticulin (CRT) from the endoplasmic reticulum (ER) to the cell surface along with the release danger associated molecular patterns (DAMP) such as ATP. The Purinergic P2X7 receptor plays a key role in the activation and maturation of antigen-presenting cells (APCs). Complementing its established role on APCs, we explored that how P2X7 contributes to ICD in tumour cells. Low concentrations of extracellular ATP (eATP) potentiated the cytotoxic activity of DOX in murine Yac-1 cells. This effect was inhibited by the P2X7 specific antagonistic nanobody and further synergistically increased by an agonistic nanobody. Activation of P2X7 also enhanced the initial intracellular uptake of DOX into cells. Notably, increased cell death was also observed when DOX was removed prior to eATP exposure, suggesting convergence of downstream signaling mechanisms. Similar results were also observed with Bortezomib. In *in vivo* experiments, tumours of 4T1 breast cancer cells expressing functional P2X7 showed more T cell infiltration than those expressing a non-functional mutant. Collectively, these findings propose that P2X7 signalling is closely interconnected with the ER and provides an early input into the ISR pathway, thereby modulating the outcome of this signalling cascade when it is induced by chemotherapeutic drugs.

Keywords: Immunogenic cell death, Purinergic signalling, ER stress

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Role of Pharmacist in the One Health Approach

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The One Health concept emphasizes the interconnectedness of human, animal, and environmental health, recognizing that the well-being of each depends on the others. In the field of pharmacy**,** this multidisciplinary framework plays a crucial role in addressing global health challenges such as antimicrobial resistance (AMR)**,** zoonotic diseases**, and** environmental contamination from pharmaceuticals. The One Health framework promotes cooperation among physicians, veterinarians, environmental scientists, and public health professionals to achieve optimal health outcomes for all species. Pharmacists contribute to the One Health approach through responsible antibiotic stewardship, ensuring rational drug use in both human and veterinary medicine. They can evaluate antibiotic dispensing patterns in community pharmacies and their effect on antimicrobial resistance. Pharmacist-led antibiotic stewardship program which is integrating human and veterinary medicine can be a valuable source in one health program. To execute that program, pharmacist can monitor antibiotic prescription and its responsible usage, thus ensuring the reduction in spread of resistant pathogens in humans, animals and ecosystem. Many infectious diseases (COVID-19, avian influenza, rabies) are zoonotic, requiring cross-sectoral collaboration. They also participate in monitoring and minimizing the **eco-**toxicological impact of pharmaceutical residues, which can disrupt ecosystems and contribute to resistant microbial strains. Support of pharmacist regarding sustainable innovation in drug design aligned with One Health sustainability goals can be remarkable. Future pharmacist must be trained to think across human-animal-environment interfaces. For the reduction of environmental toxicity pharmacist can develop green pharmacy practices, eco-friendly formulations and for the reduction of dosing frequency and waste generation, they can utilize nanotechnology-based drug delivery system. Thus, pharmacists serve as essential partners in the One Health initiative, bridging healthcare sectors to safeguard human, animal, and environmental health collectively.

Keywords: Antimicrobial resistance, Ecosystem, Zoonotic disease, Pathogens

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Carvone-Loaded Chitosan Nanoparticles Alleviate Joint Destruction by Downregulating the Expression of Pro, Inflammatory Cytokines and MMP-13 in Adjuvant-Induced Rat Model

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Rheumatoid arthritis is an autoimmune illness causing deformity, oedema, and joint tenderness. Its long-term treatment burdens the healthcare system and leads to toxicity, and thus, finding safe, effective, and affordable therapies is essential. Rheumatoid arthritis can also be the manifestation of chronic inflammation, which is a major cause of death worldwide. The current study aimed to exhibit the anti-arthritic activity of Carvone-loaded chitosan nanoparticles to treat Freund's complete adjuvant (FCA) arthritis in rats Healthy albino rats (n=35) were distributed into seven groups. The 1st group worked as normal control, while the 2nd was arthritic control. The 3rd group received methotrexate (10 mg/kg/week). The 4th group received Carvone (60 mg/kg/day), while the 5th (30 mg/kg/day), 6th (45 mg/kg/day), and 7th (60 mg/kg/day) groups received Carvone-C-NPs, respectively. Nanoparticles, prepared by the ion gelation method, were characterized by zeta size, potential, scanning electron microscopy, and Fourier transform infrared microscopy. NPs have zeta size (78.82±0.02 nm) and potential (19.96±0.02 mV). A significant reduction was shown in paw swelling (5.52±0.05 mm), arthritic score (2.81±0.23), and rheumatoid factor (14.56±0.68 IU/L) by Carvone-C-NPs. qRT-PCR results showed significant down-regulation of pro-inflammatory cytokines [TNF-α (0.25±0.03), IL-1β (0.21±0.06), IL-17a (0.16±0.12), and IL-33 (0.15±0.01)] and up-regulation of anti-inflammatory cytokines [IL-4 (0.85±0.06) and IL-10 (0.66±0.04)] in ankle joint of Carvone-C-NPs treated group. The radiographical and histopathological findings showed reduced pannus formation, joint swelling, and synovial hyperplasia in the Carvone-C-NPs treated group. Overall, it is concluded that Carvone-C-NPs have remarkable anti-arthritic activity and promising anti-inflammatory properties.

Keywords: Carvone, Arthritis, Oxidative stress, Inflammation

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Formulation and Evaluation of Chitosan Nanoparticles Cream Loaded with Lemon Extract for Enhanced Antioxidant and Antimicrobial Activity

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The growing demand for natural, safe, and effective therapeutic agents has intensified research into plant-derived bioactives and advanced delivery systems. Lemon (*Citrus limon*) extract, rich in flavonoids, vitamin C, and phenolic compounds, possesses potent antioxidant and antimicrobial properties; however, its therapeutic potential is often limited by instability, degradation, and poor bioavailability. The present study aimed to formulate and characterize chitosan nanoparticles encapsulating lemon extract to enhance its stability, controlled release, and biological efficacy. To overcome these challenges, biocompatible and biodegradable polymers, such as chitosan was employed to formulate nanoparticles using the Nano precipitation method. In this study, *Citrus lemon* extracts were subjected to testing for active principles of vitamin C, alkaloids, glycosides, phenolic, flavonoids, carbohydrates and tannins. Total flavonoid contents were 587.51mg/ml. 2, 2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay exhibited 47.33% inhibition. The optimized formulation exhibited a mean particle size of 120 ± 10 nm, a positive zeta potential (+35 mV), and an encapsulation efficiency exceeding 80%. Fourier-transform infrared spectroscopy (FTIR) confirmed successful encapsulation of lemon extract within the chitosan matrix. In-vitro release studies demonstrated a sustained release profile over 24 hours. Antimicrobial evaluation against *Escherichia coli* and *Staphylococcus aureus* revealed improved inhibitory zones, indicating synergistic effects of chitosan and lemon bioactives. These findings suggest that chitosan-based nanoparticles of lemon extract offer a promising, eco-friendly nanoformulation with potential applications in pharmaceutical, nutraceutical, and cosmeceutical fields. This work supports the development of green nanotechnology approaches aligned with the One Health concept, emphasizing the interconnection between human, animal, and environmental health.

Keywords: Chitosan, Citrus lemon extract, DPPH, Nanofomulation

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Food Supplements for Gastrointestinal Health: From Mechanistic Insights to Clinical Evidence

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Gastrointestinal (GI) health is central to overall well-being, with the gut microbiota playing a pivotal role in digestion, immunity, and systemic balance. Dysbiosis is linked to functional GI disorders such as functional dyspepsia (FD) and functional constipation (FC), which substantially impair quality of life. While lifestyle modification remains first-line therapy, there is growing demand for safe, natural, and effective interventions. This lecture presents a translational research pipeline, from preclinical screening to human clinical studies, designed to evaluate standardized botanical extracts and nutraceutical formulations for GI health. Using advanced *in vitro* models, we showed that a polyphenol-rich poplar-type propolis extract, after simulated digestion and fermentation, exerted a strong prebiotic effect. It modulated the gut microbiota of healthy and diseased donors, enriching *Bifido bacterium* and *Faecali bacterium* and enhancing short-chain fatty acid (SCFA) production. In another study, a chemically characterized *Hippophae rhamnoides* fruit extract upregulated aquaporin-3 (AQP3) expression in colon cells, suggesting a novel mechanism for stool hydration and constipation relief. In parallel, we also assessed clinically distinct nutraceutical interventions aimed at improving GI function. A two-month randomized controlled trial of a multi-enzyme complex (amylase, protease, lipase, cellulase) in FD patients significantly improved quality of life, reduced pain, and enhanced sleep quality compared with placebo, with excellent tolerability. A consumer survey on *Malva sylvestris* extract, rich in mucilage and polyphenols, demonstrated high efficacy in FC, improving bowel frequency, stool consistency, and abdominal pain. These studies highlight the therapeutic promise of nutraceuticals and food supplements in addressing GI disorders through mechanisms spanning microbial modulation, SCFA production, enzyme supplementation, and water transport.

Keywords: Gastrointestinal health; Nutraceuticals; Functional gastrointestinal disorders

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Ethical Dimensions of AI Balancing Innovation and Responsibility

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Artificial Intelligence (AI) has emerged as a transformative force across science, technology, education, arts, and social sciences, reshaping the way societies function and innovate. From advancing medical diagnostics and personalized learning to optimizing business operations and enabling data-driven governance, AI offers unprecedented opportunities for progress. However, alongside these innovations come profound ethical challenges that demand careful consideration. Issues such as algorithmic bias, threats to privacy, lack of transparency, job displacement, and the misuse of AI for harmful purposes raise questions about accountability, fairness, and trust in technological systems. The ethical dimensions of AI with a focus on balancing innovation and responsibility need to be addressed. Key principles including fairness, accountability, transparency, and inclusivity, while highlighting the role of regulatory initiatives such as the European Union AI Act and other global policy frameworks, will be addressed in this presentation. Beyond regulation, the discussion emphasizes responsible innovation practices, embedding ethical reflection into AI design and deployment. Importantly, the presentation underscores the necessity of multi-stakeholder engagement—bringing together technologists, policymakers, ethicists, educators, and the public—to ensure AI development remains human-centred and socially beneficial. By bridging the gap between technological potential and ethical responsibility, this work argues for a balanced pathway where AI continues to drive creativity and progress without compromising human dignity, social justice, and sustainability. In the context of STEAM education, it further demonstrates how ethical literacy and interdisciplinary collaboration can prepare future generations to harness AI responsibly for shaping a more equitable and inclusive future.

Keywords: Responsible innovation, Interdisciplinary collaboration, STEAM education, Sustainability, Human-centered AI

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Plums as Natural Inducers of Cancer Cell Apoptosis: A Conceptual Insight into the Role of Herbal Therapies in Modern Cancer Management

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Cancer continues to pose a major global health challenge accounting for millions of deaths annually despite advances in modern medicine. Conventional cancer treatments such as chemotherapy, radiotherapy and targeted therapies though effective to some extent and are often associated with high toxicity, drug resistance and adverse systemic effects. These limitations have encouraged a paradigm shift towards natural, plant derived interventions that offer safer, holistic and more sustainable therapeutic alternatives. Among such promising candidates are plums (*Prunus domestica L.*), nutrient-rich fruits endowed with diverse phytochemicals known for their profound biological activities. Plums are abundant sources of phenolic acids, flavonoids, anthocyanins and other antioxidants that collectively contribute to their anticancer potential. Emerging evidence suggests that plum extracts can selectively trigger apoptosis (the self-destruction mechanism of damaged or malignant cells without harming normal healthy tissues). This apoptotic induction occurs through multiple molecular pathways, including the activation of caspase enzymes, disruption of mitochondrial membrane potential and modulation of key regulatory proteins. These mechanisms collectively result in DNA fragmentation and suppression of tumor proliferation. Furthermore, bioactives of plum help in neutralizing free radicals, reducing oxidative stress and inhibiting inflammatory mediators thereby creating a biochemical environment that is unfavorable for cancer cell survival and metastasis. They not only strengthen the body's intrinsic defense mechanisms but also promote overall well-being by supporting immune balance, detoxification and cellular repair. Importantly, phytochemicals from natural sources provide a cost-effective and accessible approach to disease prevention particularly in low and middle income countries where healthcare resources are limited. The potential of plums and similar plant derived agents offers a compelling foundation for future translational research aimed at developing natural, safe and sustainable strategies against cancer.

Keywords: Plum, DNA fragmentation, Cancer

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Serum Levels of Angiopoitin-1 in Diabetic and Non-Diabetic with Post Myocardial Infarction

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Diabetes is a metabolic disease related to either due to lack of insulin or insulin resistance. Cardiovascular diseases e.g. myocardial infarction and stroke is among the leading causes of death in diabetic patients. Angiopoietin-1 is most important angiogenic determinants being considered to be studied extensively for therapeutic intervention of MI. It has been speculated that in the myocardium suffering from ischemia, treatment with Ang-1 exogenously can augment their restorative effects and decrease potential adverse effects. Angiopoietin-1 is important for adhesion, vessel growth into maturation, transportation, and survival. It can restore poorly remodeled and leaky vessels. To determine the serum levels of Angiopoietin-1 in diabetic patients compared to non-diabetic subjects having myocardial infarction. After getting approval from Institutional Ethical Review Board. A cross sectional comparative analysis of 80 patients were started that were divided into two groups. Group A consisted of n=40 diabetic after 6 months myocardial infarction patients whereas, group B contains 40 non-diabetic after 6 months of myocardial infarction patients. Serum levels of Ang-1 had been measured by ELISA kit (Catalog No: E-EL-H6119) BMI, HbA1c and lipid profile was also recorded. All the data was entered and analyzed using SPSS, version 26. A 'p' value of ≤ 0.05 was considered statistically significant. Mean serum levels of Ang-1 in diabetic and non-diabetic subjects suggesting that the diabetic patients with MI have significantly higher serum levels of Ang-1. ($p > 0.001$). The patients in diabetic group showed significantly increased levels of lipid profile: Total cholesterol ($p > 0.047$), LDL, ($p > 0.001$), TGs ($p > 0.001$) and HDL ($p > 0.008$). Diabetic patients with MI also exhibited raised HbA1c ($p = 0.014$), and BMI. ($p > 0.001$) as compared to non-diabetic MI patients. Ang-1 can be utilized as a therapeutic intervention and can also be utilized as potential biomarker for managing MI patients with diabetes.

Keywords: Angiopoitin 1, Diabetes mellitus type 2, Myocardial infarction

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Prunus domestica subsp. *syriaca* Fruit Extract: A Bioaccessible Nutraceutical for Postprandial Hyperglycemia Management

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Prunus domestica L. subsp. Syriaca (European plum) fruits are rich in polyphenols and have a low glycemic index, making them a promising natural intervention for hyperglycemia and insulin resistance. This study evaluated the hypoglycemic and insulin-sensitizing effects of a hydroethanolic fruit pulp extract and assessed its bio-accessibility through simulated digestion. *In vivo*, oral administration of the extract (750 mg/kg) to BALB/c mice significantly reduced blood glucose and insulin levels within 10–20 minutes of sugar challenge. Complementary *in vitro* assays using SW872 cells demonstrated enhanced glucose uptake, indicating improved insulin sensitivity. Metabolite profiling by RP-UHPLC-MS/MS identified nine phenolic compounds, including hydroxycinnamic acid derivatives and procyanidin dimers. Simulated digestion revealed a transient loss of polyphenols during the gastric phase, followed by a marked increase in their release during the duodenal phase, suggesting high intestinal bio-accessibility. Together, these findings demonstrate that *P. domestica* fruit pulp extract exerts potent hypoglycemic and insulin-sensitizing effects, supported by the efficient intestinal release of bioactive phenolics. These results highlight its potential as a bio accessible nutraceutical or functional food ingredient for managing postprandial hyperglycemia.

Keywords: *Prunus domestica* L.; Hyperglycemia; Insulin sensitivity; Bio-accessibility, Postprandial glucose

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Fabrication of Wound Healing Hydrogel Using Novel Oligomers

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Biocompatibility and injectability characteristics can be inculcated in a hydrogel when suitable combination of polymeric materials is selected. Due to their tissue regeneration potential, the gelatin based-hydrogels can be a promising delivery system in wound healing therapeutics. In order to overcome the limited mechanical strengths and rapid degradation rates of these hydrogels, gelatin is combined with novel oligomers in different ratios. Animal model was used to access the wound healing potential of these hydrogels for broader future applications. A series of hydrophilic, reactive anhydride-based oligomers were synthesized using free radical polymerization reaction. After necessary characterization, these oligomers were mixed with gelatin in suitable ratios to produce gelatin-based crosslinked hydrogels. The hydrogels were then characterized using both *in-vitro* and *in-vivo* assays. Low molecular weights (Mn < 5 kDa), with varying degree of reactivity and comonomer composition were some of the basic characteristics of the formed oligomers. These oligomers resulted in hydrogels with different mechanical strengths and degradation profiles. These hydrogels showed comparable wound healing effect in the animal model vs the standard. Oligomer-crosslinked hydrogels were successfully prepared using a combination of reactive MA-containing oligomers and gelatin. These oligomer-crosslinked gelatin-based hydrogels show potential as drug carrier in wound healing therapeutics.

Keywords: Hydrogels, Wound healing, Free radical polymerization, Rheology

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Prunus domestica subsp. *syriaca* Fruit Extract Mitigates Key Pathological Features of Metabolic Dysfunction-Associated Fatty Liver Disease (MASLD)

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Metabolic dysfunction-associated fatty liver disease (MASLD) is characterized by disrupted glucose uptake, oxidative stress, and increased de novo lipogenesis. Natural extracts offer a promising, sustainable strategy to modulate these pathogenic mechanisms and slow disease progression. This study evaluated the effects of a *Prunus domestica* L. subsp. syriaca extract on a cell-based model of steatotic hepatocytes (HepG2-OA), which mimics key pathophysiological features of MASLD. The extract (0.01–1 mg/mL) was evaluated for its impact on cell viability, glucose uptake, lipid accumulation, oxidative stress, and expression of key metabolic genes. The extract was well tolerated, showing no cytotoxicity after 24–48 h. The extract significantly increased glucose uptake in a dose-dependent manner after both 6 and 24 hours. Furthermore, it reduced lipid accumulation and downregulated the expression of key lipogenic genes, including *DGAT1* and *FASN*. The extract also reduced ROS production and downregulated the expression of oxidative stress-related genes, *SOD* and *CAT*, in the HepG2-OA cells. Our findings demonstrate that *P. domestica* extract effectively modulates critical molecular mechanisms related to glucose metabolism, lipogenesis, and oxidative stress. These results support its potential as a nutraceutical candidate for the management of MASLD.

Keywords: MASLD; Fatty liver; Glucose metabolism; Oxidative stress

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Disrupting Fibrogenic Pathways: In Silico and In Vitro Evaluation of Kaempferol and Coumestrol as Potential Anti-Fibrotic Agents

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Liver fibrosis is caused by chronic liver injury which is a reversible process of excessive extracellular matrix deposition. The continuous activation of hepatic stellate cells progresses to fibrosis, resulting in cirrhosis and hepatocellular carcinoma. Conventional treatment focuses only on the symptoms, but natural phytochemicals as antifibrotic drugs offer a prospective option for novel therapeutic techniques that target fibrogenic pathways. The objective of this study was to explore the hepatoprotective potential of selected phytochemicals using computational and experimental approaches involving fibrogenic pathways. The bioactive compounds of medicinal plants *Euphorbia hirta* (whole plant) and *Lepidium sativum* (seeds) were studied. The 69 phytochemicals were molecular docked against IL6, AKT1, EGFR, and CASP3 proteins. Safety was assessed by ADMET profiling, while cytotoxicity, migration, invasion, and gene expression effects of Kaempferol and Coumestrol were assessed by in vitro assays. Statistical analysis was conducted using SPSS software. Kaempferol and Coumestrol were chosen from 69 phytochemicals based on high binding energies and atomic interactions with proteins. Coumestrol showed superior anti-invasive properties, and higher binding affinities with AKT1 (-6.4 kcal/mol), EGFR (-7.1 kcal/mol), and CASP3 (-7.1 kcal/mol) when compared to Kaempferol, plus no AMES toxicity and exceeded total clearance (8.085) of Kaempferol (6.868). Kaempferol exhibited greater cytotoxicity, colony-building inhibition, and stronger inhibition of cancer cell viability (38.8%) compared to Coumestrol (53.6%). Both bioactive compounds downregulated EGFR, AKT1, and IL6 while upregulating Caspase-3 expression, to efficiently target the fibrogenic pathways. The study concluded that *Euphorbia hirta* (whole plant) and *Lepidium sativum* (seeds) have the potential for hepatoprotection for liver fibrosis.

Keywords: Coumestrol, *Euphorbia hirta*, Fibrogenic pathways, Kaempferol, *Lepidium sativum*

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Prunus domestica subsp. *syriaca* Fruit Extract: A Promising Source of Bioactive Compounds for Cardiometabolic Health

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High consumption of fruits and vegetables is inversely associated with cardiometabolic risk factors. This study aimed to chemically characterize the hydroethanolic extract of *Prunus domestica* L. subsp. syriaca (European plum) fruit pulp and evaluate its inhibitory activity against key metabolic enzymes and inflammatory mediators. Using ultra-high-performance liquid chromatography-high-resolution mass spectrometry (UHPLC-HRMS), we identified several classes of bioactive compounds, including hydroxycinnamic acids, flavanols, and glycoside flavonols. Nuclear magnetic resonance (NMR) analysis confirmed the presence of various saccharides, with glucose being particularly abundant. The extract demonstrated significant inhibitory activity against enzymes relevant to cardiometabolic health, including α-amylase (IC_{50}: 7.01 mg/mL), α-glucosidase (IC_{50}: 6.4 mg/mL), pancreatic lipase (IC_{50}: 6.0 mg/mL), and HMG-CoA reductase (IC_{50}: 2.5 mg/mL). Furthermore, the extract effectively inhibited the lipopolysaccharide-induced production of pro-inflammatory mediators, specifically nitrite, interleukin-1β, and prostaglandin E_2 (PGE_2) in activated J774 macrophages. These *in vitro* findings suggest that *P. domestica* fruit extract exerts bioactive effects through enzyme inhibition and modulation of inflammatory mediators, supporting its potential role in managing cardiometabolic disorders. This research highlights the potential of European plum as a source of functional compounds, warranting further investigation into its applications for human health.

Keywords: *Prunus domestica* L.; Cardiometabolic diseases; Enzyme inhibition; Anti-inflammatory activity

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Pharmacy
Poster Presentations

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Investigating the Role of Genetic Variations of *ABCB1* (rs1045642) and *CYP7A1* (rs3808607) Genes on Serum Lipid Level among Malaysian Male Patients Treated with Atorvastatin

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The Objective of this study was to explore the allele frequency and associations between the presence of single nucleotide polymorphisms (SNP) in the *ABCB1* (rs1045642) and *CYP7A1* (rs3808607) genes on lipid-lowering efficacy of atorvastatin among Malaysian male patients. The study included 64 subjects from a previous genetic association study among male patients who were on atorvastatin. The study was carried out at HUSM, Kelantan, Malaysia from December 2023 to October 2024. The patients were split into 2 groups, each consisting of 32 subjects such as controlled (LDL level <3 mmol/L) and uncontrolled (LDL level ≥3 mmol/L). After genotyping each participant, the influence on their lipid profile was determined. The genotype frequency of genes *ABCB1* (rs1045642) and *CYP7A1* (rs3808607) was higher in the variant allele GG (37.5%) and TT (36%), respectively, compared with the reference allele. Patients with the variant genotype of *ABCB1* and reference genotype of *CYP7A1* were more likely to be observed in the controlled group in response to atorvastatin. A significant correlation was found between the genotype *ABCB1* (rs1045642) and HDL levels (p=0.045).
The allele frequency of the heterozygous group was higher in both studied SNPs. The variant allele of gene *ABCB1* and the reference allele of *CYP7A1* showed a more favorable lipid profile.

Keywords: Gene *ABCB1* (rs1045642), *CYP7A1* (rs3808607) Gene, SNP, Atorvastatin, LDL

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Assessment of Knowledge, Attitude and Practices of Community Pharmacists (Cps) Towards Promethazine Misuse for Paediatric Sedation in Pakistan

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Promethazine (PMZ) is a potent H_1-recepter antagonist and used mostly to treat the allergic symptoms and vomiting. Due to its sedative properties, parents found to administer the drug to their children to improve infant's sleep that may result in potentially lethal Adverse Drug Reactions (ADRs) such as respiratory depression, coma and death of neonates and infants. Role of community pharmacists is vital to manage drugs misuse. Therefore, we decided to assess their knowledge, attitude and practices and to highlight the violation of national drug laws in Pakistan. Cross-sectional survey, between Dec-2019 and May-2020 was conducted using pre-validated tool (Cronbach's Alpha > 8). Convenience sampling method was used due to low rate of availability of CPs. Q-Survey (Office: Doha, Qatar) was used to collect data. CPs having at least one year community pharmacy experience were included. Analysis of Variance (ANOVA), Least Significant Difference (LSD), Chi-square test (χ^2), Pearson's correlation tests and simple descriptive tests were used to analyse data. 76 CPs from different cities of Punjab including capital (Islamabad) participated in this survey. One third of CPs found to have good knowledge. Majority (75%) of CPs had misperception that PMZ can improve sleeping disorders. Statistically significant relationship found between education level and knowledge score ($p < 0.05$). Over 80% of CPs supported limiting the availability of PMZ as over-the-counter drug. However, One-third remained promoting for illicit drug use. Almost 60% were actively involved in the patient counselling. More than half CPs did never contact physicians to eradicate any prescription error. Majority of CPs found to have lack of sufficient knowledge about PMZ, ADRs and black box warning. CPs should enhance their involvement in patient counselling. There is an urgent need to implement national drug laws to control drugs misuse. Physician-pharmacist relationship needs to be improved for the sake of positive health outcomes especially in pediatric population.

Keywords: Role of community pharmacists, Promethazine, Paediatric population, Sleeping disorders, Off-label use

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Resveratrol Mitigates Bisphenol A-Induced Metabolic Disruptions: Insights from Experimental Studies

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This study aimed to investigate BPA-induced disruptions in metabolic pathways and explore the therapeutic potential of resveratrol (RSV) in mitigating these effects through modulation of biochemical pathways. Wistar albino rats were divided into three groups: group 1 served as the control, group 2 received 70 mg/Kg of BPA, and group 3 received 70 mg/kg of BPA along with 100 mg/Kg of RSV. After the treatment period, various biomarkers and gene expressions were measured to assess the effects of BPA and the potential protective effects of RSV. The results revealed that BPA exposure significantly increased the serum levels of α-amylase, α-glucosidase, G6PC, insulin, HbA1c, HMG-CoA reductase, FFAs, TGs, DPP-4, MDA, and proinflammatory cytokines such as TNF-α and IL-6. Concurrently, BPA exposure led to a reduction in the levels of antioxidant enzymes such as catalase (CAT), glutathione peroxidase (GPx), and superoxide dismutase (SOD), as well as GLUT4 and HDL cholesterol. However, the administration of RSV along with BPA significantly ameliorated these alterations in the biomarker levels induced through BPA exposure. RSV treatment effectively reduced the elevated levels of α-amylase, α-glucosidase, G6PC, insulin, HbA1c, HMG-CoA reductase, FFAs, TGs, DPP-4, MDA, and proinflammatory cytokines, while increasing the levels of antioxidant enzymes, GLUT4, and HDL cholesterol. Furthermore, BPA exposure suppressed the mRNA expression of glucokinase (GCK), insulin-like growth factor 1 (IGF-1), and glucose transporter 2 (GLUT2) and up-regulated the mRNA expression of uncoupling protein 2 (UCP2), which are all critical biomarkers involved in glucose metabolism and insulin regulation.

Keywords: Insulin growth factor 1; Metabolic disorders; Endocrine disruptor; Uncoupling protein 2; RT-qPCR

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Metabolomic Analysis of Nicotine-Induced Metabolic Disruptions and Their Amelioration by Resveratrol

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This study investigates the metabolic disruptions caused by nicotine (NIC) exposure, with a particular focus on amino acid and lipid metabolism, and evaluates resveratrol (RSV) as a potential protective agent. Mice were divided into four groups: control (CON), NIC-exposed, NIC + RSV-treated, and RSV-only. NIC exposure resulted in significant weight loss, elevated glucose levels, altered lipid profiles, and organ damage, particularly in the liver and kidneys. Increased inflammation was evidenced by elevated levels of IL-6 and CRP. In contrast, RSV treatment mitigated these effects by improving lipid profiles, glycemic indices, and reducing inflammatory markers. Histopathological analysis confirmed reduced tissue damage in the NIC + RSV group compared to the NIC-alone group. Metabolomics analysis using LC-MS/MS revealed significant dysregulation in lipid, amino acid, and nucleotide metabolism in NIC-exposed mice. Fold-change analysis identified altered metabolites, including sphingomyelin 36:1;02 ($p < 0.001$), valine ($p < 0.001$), triacylglycerol 4:0–18:1 ($p < 0.001$), and ceramide 32:1;02 ($p < 0.001$). Amino acids such as arginine, phenylalanine, glutamic acid, tyrosine, and lysine, as well as NIC metabolites like nornicotine and cotinine, were identified, underscoring molecular fragmentation analysis findings. RSV treatment partially restored metabolic balance, highlighting its role as a metabolic modulator. This study underscores the therapeutic potential of RSV in alleviating NIC-induced metabolic dysfunctions by restoring lipid homeostasis and reducing inflammation. Additionally, it emphasizes the importance of RSV in addressing NIC-related metabolic impairments and the need for noninvasive biomarkers for early disease detection.

Keywords: Nicotine, Resveratrol, Metabolomics, Targeted metabolomics, Lipids, Amino acids, Nucleotides

Knowledge and Attitude Towards Botulinum Toxin Use in Cosmetic Injections: A Cross-Sectional Study of the General Population

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Botulinum toxin (BT), widely known as Botox, has become a popular option for cosmetic enhancement, particularly in facial rejuvenation and wrinkle reduction. Although its effectiveness in achieving aesthetic improvements is well recognized, public awareness and understanding of this neurotoxin remain an important consideration. This study explores the knowledge and attitudes toward the use of botulinum toxin in cosmetic injections among the local population. A cross-sectional design was applied using a self-administered online questionnaire distributed through social media between May and July 2024. Randomized sampling targeted adults aged 18 years and above, regardless of gender, residing in Arar. Data collection was conducted via a Google Forms survey translated into the appropriate language. Both descriptive and inferential statistical methods were used to analyze the responses. A total of 410 individuals participated. The largest proportion of respondents (149; 36.3%) fell within the 20–25 age group, while the smallest (6; 1.5%) were aged 50–55. Females represented the majority (341; 83.2%), compared with males (69; 16.8%). Overall, 262 (63.9%) participants were familiar with Botox use in cosmetic practice. When asked about common non-surgical cosmetic procedures, 29 (7%) cited dental treatments, and 19 (4.6%) reported its application for pain management. Findings revealed that nearly two-thirds of participants were aware of Botox applications in aesthetic medicine, with younger, female, and unmarried individuals showing higher knowledge levels. However, only 83 (20%) recognized the possible side effects of botulinum toxin. The limited awareness of associated risks highlights the need for better public education and outreach to ensure safe cosmetic practices.

Keywords: Botulinum toxin, Botox, Aesthetic medicine

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Physics
Oral Presentations

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Investigation of Female Diseases Using Laser-Induced Breakdown Spectroscopy Assisted with Machine Learning

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One of the biggest problems facing modern healthcare is the early and precise detection of diseases affecting women. This work investigates the use of machine learning (ML) algorithms in conjunction with laser-induced breakdown spectroscopy (LIBS) as a quick and non-invasive diagnostic method. While ML improves data interpretation by spotting minute spectrum differences associated with clinical states, LIBS offers the elemental and chemical fingerprints of biological samples. The resulting spectra were processed using feature extraction, dimensionality reduction, and classification models like Random Forest, Support Vector Machines, and one-dimensional Convolutional Neural Networks after biological specimens like blood, cervical swabs, and tissue biopsies were examined under standardized LIBS conditions. According to preliminary results, LIBS-assisted machine learning (ML) distinguishes between healthy and diseased samples with good sensitivity and specificity, and it may be able to develop elemental biomarkers. Early results show that LIBS-assisted ML is very good at telling the difference between diseased and healthy samples. This means that it could be used to find elemental biomarkers linked to diseases like endometriosis, ovarian cancer, breast cancer and cervical cancer.

Keywords: Laser-induced breakdown spectroscopy, Neural networks, Female diseases, Cervical cancer, Breast cancer

Radiology & Imaging Sciences
Oral Presentations

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Triphasic Contrast- Enhanced Computed Tomography's Use in the Characterization of Liver Lesions in the Diabetic Population

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Liver lesions are the most common cause of death all over the world. Early detection is very important for the treatment. This study's goal was to evaluate the detection of liver lesions in diabetic patients by using the CT scan as a gold standard. A study was conducted at Islamabad Diagnostic Center, Faisalabad. Before the CT exam, each patient signed a written informed consent form. In this study, 59 patients were examined. All patients were diagnosed with liver lesions, and their findings were evaluated using CT-Scan. This study looks into the clinical and demographic features of liver lesions in five hundred and ninety-nine people with diabetes. The age distribution shows that the majority of participants are middle-aged, with 47.1% between 51 and 60 years old. Men make up a larger share (62.7%) than women (37.3%), according to a gender study. According to the study, there are more hypovascular lesions (60.0%) than hypervascular lesions (40.0%). An examination of the symptoms indicates that the most common complaint was abdominal discomfort (74.6%). Furthermore, cirrhotic liver (81.4%) was the most common condition found on CT scans of diabetic individuals, followed by hepatomegaly (67.8%) and hepatic cysts (39.0%). By highlighting unique lesion characteristics and clinical patterns linked to both diabetes and Hepatitis C, the study advances our knowledge of liver disease in this patient population. Early detection with triphasic contrast-enhanced CT helps improve the treatment outcomes and survival. Thus, supporting treatment planning, staging, diagnosis, and treatment response.

Keywords: Diabetes, Hepatitis C, Hypovascular lesion, Hypervascular lesion

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X-Ray Lumbar Spine for evaluation of Lower Back Pain in Women after Cesarean and Normal Vaginal Delivery

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The previous researchers have emphasized the prevalence of lower back pain in women after cesarean or normal vaginal delivery, but there is still limited investigation into its structural causes. This highlights the need for an imaging-based assessment to evaluate the changes in lumbar vertebrae, particularly the intervertebral disc spaces. Due to its wide availability, low dose of radiation, modern advancements, and versatility, X-ray imaging becomes an effective tool for identifying such changes in postpartum women. The study aimed to determine the benefits of using X-ray as a first-line diagnostic tool in evaluating the lumbar spine for post-partum lower back pain. The Department of Radiology at Madinah Teaching Hospital, Allied Hospital, and Mujahid Hospital, Faisalabad served as the study's analytical and cross-sectional director. One hundred patients from two groups (cesarean section and normal vaginal delivery) were selected through non-random sampling. A total of 100 postpartum women with lower back pain were included, with 69 having cesarean sections and 31 having normal vaginal deliveries. Lumbar spine X-rays were used to assess disc space narrowing. No statistically significant association was found between delivery type and disc narrowing ($p > 0.05$). It is suggested that radiographic evaluation alone may not be sufficient to explain lower back pain symptoms. So, a comprehensive evaluation including clinical, functional, and advanced imaging is recommended for accurate diagnosis. Future studies with larger sample sizes and longitudinal follow-up are warranted to better understand the underlying mechanisms and contributing factors. Hence, a multidisciplinary assessment combining clinical examination, functional evaluation, and advanced imaging techniques is recommended to achieve a more precise understanding and diagnosis of lower back pain.

Keywords: Disc space narrowing, Postpartum lower back pain, Cesarean section, Normal vaginal delivery, Mode of delivery

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Frequency of Lumbar Disc Herniation in Adults on MRI

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Since MRI provides full images of the disc herniation and surrounding soft tissues, it is a sensitive imaging modality for identifying lumbar disc herniation. It can also be used to regulate the severity and place of herniation. The study aimed to determine the prevalence of adult lumbar disc herniation on MRI in the city of Faisalabad. The Department of Radiology at Madina Teaching Hospital and Aziz Fatima served as the study's analytical, cross-sectional director. In this study, 100 patients with lumbar disc herniation problems were found. The sample consists of 59% male and 41% female participants, indicating a higher representation of males in the study. Approximately 82% patients experienced either acute or chronic back pain, while 18% reported no back pain. The majority of disc herniations occurred at the L4 and L5 levels. About 51% of participants reported nerve root compression. A typical MRI finding, especially in people with lower back discomfort, was a Lumbar disc herniation. The population under study and the parameters used to determine herniation influence the prevalence of lumbar disc herniation. To diagnose and treat LDH, an MRI is essential. The prevalence of lumbar disc herniation varies depending on the population under study and the parameters used to define herniation. MRI remains an indispensable diagnostic tool for accurate evaluation, management, and treatment planning of lumbar disc herniation.

Keywords: Lower back pain, Degenerative changes, MRI, Lumber area, Compression of nerve roots, Protrusion

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Biophysical Profile in the Third Trimester of Pregnancy in Anemic Patients

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Anemia is a common problem that can happen during pregnancy, especially in the third trimester. It can be bad for both the mother and the baby. In these situations, it is very important to keep an eye on the health of the fetus. The biophysical profile (BPP) is a non-invasive test that uses heart rate monitoring and ultrasound to check the health of the fetus. It looks at heart rate patterns, amniotic fluid volume, muscle tone, breathing, and body movements. This study evaluates the efficacy of BPP in assessing fetal health in third-trimester pregnant women diagnosed with anemia. The study comprised women exhibiting hemoglobin levels beneath 11 g/dL, classified into mild, moderate, and severe anemia groups. A standard BPP test was given to each participant, and the results were looked at in relation to how bad their anemia was and how well their pregnancy went. Of the 100 people who took part, 28% had mild anemia, 70% had moderate anemia, and 2% had severe anemia. The total BPP scores varied from 3 to 10, with a mean ± standard deviation of 8.22 ± 1.43 and a median score of 8.0. Most women had normal BPP scores, which meant that the health of the fetus was generally good. However, women with severe anemia had lower BPP scores more often, which suggests that there is a direct link between the severity of anemia and the health of the fetus. These findings indicate that maternal anemia in the third trimester is markedly correlated with diminished fetal well-being. Regular biophysical profiling in anemic pregnancies is thus beneficial for the early identification of fetal distress. Continuous monitoring via BPP can enable prompt clinical interventions, enhancing both maternal and neonatal outcomes by averting complications associated with oxygen deficiency and growth restriction.

Keywords: Anemia, Fetal breathing movements, Fetal tone, Fetal movement, Amniotic fluid volume, Non-Stress test

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Correlation Between Clinical Symptoms and MRI Findings Associated with Knee Joint Pain Among Females in Faisalabad City

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Knee joint pain is a major cause of disability among women, significantly affecting mobility and quality of life. In Pakistan, particularly in urban areas like Faisalabad, there is limited research on the prevalence and associated factors. The growing incidence of knee pain has been linked to sedentary lifestyles, poor dietary habits, obesity, and aging. MRI findings such as osteoarthritis, Baker's cyst, and joint effusion reflect the combined effects of these lifestyle and physiological factors. This study revealed a high prevalence of knee pain among women, with nearly half of the participants experiencing pain in both knees and over half reporting moderate to severe intensity. Sedentary behavior (43.8%) and unhealthy diet (41.2%) were common among those affected. Statistical analysis showed significant associations between diet and pain duration, as well as between knee-related conditions and pain severity. Age emerged as the strongest predictor of pain severity, explaining 27% of the variance, indicating that degenerative changes increase with advancing years. MRI results showed osteoarthritis (35.9%) as the most common pathological finding, followed by Baker's cyst and joint effusion, particularly among women with lower physical activity and higher pain levels. These structural abnormalities emphasize the strong influence of lifestyle and metabolic factors on joint degeneration. Despite available treatments, preventive measures remain essential. Encouraging early lifestyle modifications such as regular physical activity, balanced nutrition, and timely medical checkups can help reduce the burden of knee pain. The Mediterranean diet is promoted for cardiovascular and metabolic health. Adopting healthy habits focused on joint health could play a vital role in minimizing knee pain and improving the quality of life for women in Pakistan.

Keywords: Osteoarthritis, Pain severity, Physical activity, MRI

Radiology & Imaging Sciences
Poster Presentations

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Evaluation of Symptomatic and Asymptomatic Women With PCOS and Its Association With Infertility

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Polycystic Ovary Syndrome (PCOS) presents with a wide range of clinical, biochemical, and ultrasonographic features, leading to challenges in diagnosis and management. This study aims to compare symptomatic and asymptomatic women with PCOS across three key variables: clinical features, ultrasonographic features, and infertility in the city of Faisalabad. The Department of Radiology at Madinah Teaching Hospital served as the study site for this comparative cross-sectional study. This study includes 75 women diagnosed with PCOS, selected through purposive sampling. Participants were classified into symptomatic and asymptomatic groups. Independent samples t-tests were employed to examine group differences in levels of clinical features, presence of sonographic features, and infertility status. Statistical analysis indicated a significant difference in clinical features scores, with symptomatic women showing higher levels compared to asymptomatic counterparts ($p < 0.05$). No significant differences were found between the groups regarding sonographic features or infertility status. In conclusion, while symptomatic and asymptomatic PCOS women differed notably in clinical symptoms, they did not in ovarian morphology or infertility rates. These findings call for refined diagnostic criteria and more nuanced clinical approaches that recognize the syndrome's heterogeneity.

Keywords: PCOS, Clinical features, Infertility, Ultrasonographic features, Symptomatic, Asymptomatic, Women's reproductive health

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Characterization of Pathological Changes in Lactating Women on Breast Ultrasound

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Breast symptoms that may be indicative of a variety of benign pathological disorders are common in nursing mothers. These symptoms can be appropriately managed and prevent needless treatments. This study aims to describe the pathological alterations seen in nursing mothers' breasts and the frequency of common benign breast diseases such as engorgement, duct ectasia, galactocele, fibroadenoma, and mastitis. In this observational study, 70 nursing mothers who had breast-related symptoms such as nipple discharge, palpable lumps, discomfort, or swelling were included. Comprehensive clinical assessments were conducted, and the results were documented. Among the 70 patients, fibro adenoma was the most frequently diagnosed condition, followed by mastitis and galactocele. Duct ectasia was observed in a smaller subset, while only small cases of breast engorgement were noted. Most patients presented within the first few months postpartum, and conservative management was sufficient in the majority of cases. While several benign breast disorders arose during breastfeeding, the most prevalent ones in our research were fibroadenoma and mastitis. Targeted investigations and clinical evaluation are still necessary for precise diagnosis and efficient treatment. Understanding these trends can assist in preventing incorrect diagnoses and needless treatments for nursing mothers.

Keywords: Breastfeeding, Benign breast diseases, Fibro adenoma, Mastitis, Galactocele

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Role of Ocular Ultrasound in the Assessment of Diabetic Patients

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Diabetes mellitus is a common metabolic disease that frequently results in severe eye problems. Examples of these include retinal detachment, vitreous hemorrhage, and other abnormalities of the posterior segment that can cause partial or whole loss of vision. Direct viewing of the fundus is frequently impossible because of media opacities such as thick vitreous hemorrhage or cataracts. In these circumstances, ocular ultrasonography is a useful diagnostic technique for evaluating internal ocular structures. This study aims to describe how ocular ultrasonography may be used to detect and evaluate ocular problems in individuals with diabetes. Patients with diabetes who were referred for ocular ultrasonography due to visual problems were the subjects of this descriptive research. Among them were patients whose opaque ocular medium precluded fundoscopic inspection. Evaluation of intraocular findings was done using B-scan ultrasonography, and the results were recorded and grouped according to the observed pathology. Vitreous hemorrhage, posterior vitreous separation, retinal detachment, and tractional membranes were the most often seen ultrasonographic findings. When other imaging or examination methods were impractical, ocular ultrasonography provided vital diagnostic data. B-scan ultrasonography is a highly valuable, non-invasive diagnostic tool for evaluating posterior segment abnormalities in diabetic patients. Its role becomes particularly important when conventional fundoscopy is hindered by media opacities such as cataracts or vitreous hemorrhage. Early detection of diabetic ocular complications through B-scan imaging can greatly facilitate timely intervention and help prevent irreversible vision loss.

Keywords: Diabetic retinopathy, Retinal detachment, Vitreous hemorrhage, Posterior segment issues

Rehabilitation Sciences
Oral Presentations

Humanizing Technology: The Role of Physical Therapy in Shaping Future Health, Education, and Well-being through STEAM Integration

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In today's era of convergence among science, technology, engineering, the arts, and the social sciences, the field of physical therapy plays a unique interdisciplinary role. Beyond its clinical utility, physical therapy is the combination of scientific principles of human movement, the art of compassion and care, and the application of advanced technologies to restore functional capacity and improve the quality of life. This keynote discusses the role of physical therapy as a key integration in STEAM education, connecting technological innovation with human-centric outcomes. Technologies including digital rehabilitation tools, virtual reality-aided motor learning, and arts-integrated therapies illustrate physical therapy's role in advancing healthcare, education, and social health. By applying STEAM principles, the discipline encourages cross-disciplinary collaboration, design thinking, and solution development that can benefit human health and societal development. The inclusion of physical therapy in STEAM education underscores the importance of innovative technologies that remain focused on inclusivity, resilience, and improved global health outcomes.

Keywords: Physical therapy, STEAM, Innovation, Interdisciplinary role

Comparative Effects of Virtual Reality and Mirror Therapy: Unlocking Future Trends of Rehabilitation for Managing Phantom Neuralgia and Psychosocial Challenges in Prosthetic Users

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The perceived impact of pain after a surgically amputated extremity felt by any individual is characterized as Phantom Neuralgia. Immediately after surgery, this pain occurs among 72%-84% patients, and 67%-90% patients reported it after six months of surgery. Phantom Neuralgia not only affects the person's functional activities but also compromises patients' quality of life. This study aimed to measure the comparative effects of virtual reality and mirror therapy for managing Phantom Neuralgia and psychosocial challenges in prosthetic users. This single-blinded randomized controlled trial was conducted at the physiotherapy Department of Pakistan Society for the Rehabilitation of the Disabled, Lahore. A total of 36 Participants were randomly allocated into groups by sealed envelope method, diagnosed with Phantom Neuralgia after unilateral lower limb amputation, and wearing prostheses. Outcome measures were assessed using the Numeric Pain Rating Scale (NPRS) and the Trinity Amputation and Prosthesis Experience Scales (TAPES). Results of this study indicated significant improvement of the experimental group as compared to the control group in pain and Psychosocial Adjustment after the 4th week of treatment, as compared to baseline. Baseline TAPES Scores, general adjustment (19.22 ± 2.39 and 19.67 ± 2.76), adjustment to limitation (12.78 ± 4.36 and 11.72 ± 3.69), and social adjustment (20.22 ±1.83 and 20.05 ± 2.87), 4th Week TAPES Scores were recorded as general adjustment (22.27 ± 2.63 and 21.89 ± 2.21) and adjustment to limitation (19.67 ± 2.54 and 16.00 ± 3.97), but no significant difference was seen in social adjustment (22.67 ± 1.90 and 21.89 ± 1.99). The study concluded that virtual reality combined with mirror therapy is a useful approach and provides improved results in managing Phantom Neuralgia and psychosocial challenges among amputees.

Keywords: Phantom Neuralgia, Amputation, Psychosocial challenges

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Effects of Pulsed Magnetic Field on Gait and Spasticity of Trunk and Gluteal muscles in children with Bilateral Spastic Cerebral Palsy

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Cerebral Palsy comprises permanent abnormalities often linked with cognitive challenges, as well as musculoskeletal issues. Pulsed Magnetic Field (PMF) therapy may help manage spasticity by targeting cortical regions. Despite the sustainability of PMF, the combined impact of PMF on gait and the reduction of spasticity in Bilateral Spastic Cerebral Palsy **(**BSCP) is not well understood. The study aims to determine the effects of PMF on gait and spasticity of the trunk and gluteal muscles in children with BSCP. A controlled, randomized experiment was conducted. Those who fulfilled the inclusion criteria were incorporated into the research following informed consent. Two groups of 22 people were selected, one of whom received PMF therapy in addition to conventional therapy, and the other had conventional therapy four times a week for 12 weeks. The results were assessed at the beginning of the intervention (baseline), six weeks (T1), and twelve weeks into the intervention (T2). Results obtained indicate that the level of spasticity on MAS has reduced in group A from $3.91^{\pm}0.944$ to 1.73 ± 0.905, showing a significant decrease. For group B, the value reduces from $3.55^{\pm}0.522$ to $2.55^{\pm}0.688$. Similarly, in the case of GOAL, the values showed improvement in all gait outcomes, with group A's mean value increasing from $122.27+21.33$ to $293.81+32.16$, and for group B, values ranged from $118^{\pm}22.40$ to $184^{\pm}42.69$. PMF applied over 12 weeks demonstrated significant reductions in muscle spasticity and meaningful improvements in gait-related function in children aged 6 to 16 years with BSCP.

Keywords: Cerebral palsy, Spasticity, Gait, Torso, Lower extremity

The Effect of Somatosensory and Vestibular Training on Postural Control in Children with Autism Spectrum Disorder: A Systematic Review

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Autism Spectrum Disorder (ASD) is a complex neurodevelopmental disorder characterized by social communication deficits, abnormal repetitive movements, and parochial interests. ASD can be diagnosed at any age but as symptoms most of the times appear in first two years of life so it is denoted as developmental disorder. According to the World Health Organization, every 1 in 100 children has autism, with a 0.6% worldwide prevalence. Autistic people have an impaired sensory system, that is why they experience sensory integration difficulties resulting in over- or under-responsivity, behavioral issues, and troubles in completing functional tasks. Postural control impairment is inevitable in ASD because of sensory integration deficits. These patients are more susceptible to postural sway, especially when sensory cues are removed. This study is a systematic review aimed at finding the effect of vestibular and somatosensory exercises on postural control and balance in children with autism spectrum disorder. Databases PEDro, PubMed, Cochrane Library, Scopus, and Google Scholar were used to find relevant literature meeting the inclusion criteria. The studies published from 2011 onwards, having a PEDro score ≥5, children between the age group 6-14 years, having postural control and/or balance as outcome measures. The quality and bias of studies were evaluated through the PEDro scale and the Cochrane risk of Bias (RoB-2) tool. Initial database search yielded 651 studies, and six articles were included in this systematic review after screening. Results indicated that dual-modality approaches are effective in enhancing the static and dynamic postural stability among children with ASD. Future research should focus on conducting randomized controlled trials with a large sample size to specifically examine the effects of combined somatosensory and vestibular training on postural control.

Keywords: Autism spectrum disorder, Sensory integration therapy, Somatosensory training, Proprioceptive exercises, Vestibular training

The Relationship Between Workstation Ergonomics and Musculoskeletal Disorders Among Librarians in Public and Private Sector Libraries

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Librarians spend prolonged hours at their workstations, which require prolonged sitting, awkward postures, and repetitive movements. These physical demands, combined with poor ergonomics, lead to musculoskeletal disorders. It has become a cause of concern in public and private sector libraries. The objective of this study was to assess the relationship between workstation ergonomics and musculoskeletal disorders among librarians in the public and private sectors. A descriptive cross-sectional study was conducted by using the ergonomics-based questionnaire REBA (Rapid Entire Body Assessment) scale and the Nordic Musculoskeletal Questionnaire for musculoskeletal assessment. Data was collected from 130 individuals, of whom 119 met the inclusion criteria (both genders, working 6-8 hours per day and five to six days a week, aged 22-40) and exclusion criteria after screening the population. Data was collected from public and private sector libraries of Faisalabad. The mean age of the participants was 36.3 years, with 70% males and 30% females. Among the participants, 30.3% fall into the low-risk group (scores 2–3), and 27.7% into the medium-risk group (scores 4–7), both indicating a need for ergonomic improvements. High-risk (scores 8–10) and extremely high-risk individuals (scores 11+) make up 2% and 5% of the sample, respectively, requiring urgent intervention. Only 16.8% are at negligible risk. Over half of librarians reported pain in the neck (68.1%), shoulder (58.8%), and back (58.8%) over the past year, with even higher rates in the last week (79.8%, 63%, and 71.4%, respectively). Activity limitations were common, especially due to neck (71.4%), back (61.3%), and shoulder (59.7%) pain. Lower limb pain was less frequent but still affected many, hip/thigh (43.7% yearly, 63.9% weekly), knee (38.7% yearly, 43.7% weekly), and ankle/foot (26.1% yearly, 25.2% weekly), with activity limitations ranging from 21.8% to 52.1%. It was concluded that the high frequency of pain and activity limitation suggests poor ergonomic conditions, highlighting the urgent need for ergonomic interventions and preventive measures in librarians' workplaces.

Keywords: Ergonomics, Librarians, Musculoskeletal diseases, Public and private sectors

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Comparative effects of Buerger's Therapy versus Manual Lymphatic Drainage on Pain and Quality of Life in Varicose Vein Patients: A Randomized Clinical Trial

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Varicose veins, caused by venous insufficiency, are commonly managed with non-invasive physiotherapeutic techniques like buerger's therapy and manual lymphatic drainage. However, comparative evidence on their effectiveness remains limited. The objective was to check the comparative effects of buerger's Therapy and manual lymphatic drainage on pain in varicose vein patients. In this double-blind RCT, 18 varicose vein patients (aged 40–59) were randomly assigned to two groups at Rachana Poly Clinic, Faisalabad. Group A received buerger's exercises, while Group B underwent manual lymphatic drainage (Vodder technique), both five times weekly for four weeks. Both interventions significantly improved pain and quality of life in varicose vein patients. Group A showed a greater reduction in VAS scores (5.11 ± 0.78 to 1.88 ± 0.60) and AVVQ scores (29.00 ± 1.73 to 17.44 ± 5.29) compared to Group B (VAS: 4.88 ± 0.78 to 3.22 ± 0.67; AVVQ: 27.88 ± 2.08 to 22.55 ± 2.88), highlighting the superior effectiveness of buerger's therapy. Bberger's therapy proved to have more significant effects than manual lymphatic drainage in reducing pain and improving quality of life in varicose vein patients, suggesting it as a preferable treatment.

Keywords: Varicose veins, Buerger's therapy, Manual lymphatic drainage, Pain, Quality of life, Aberdeen varicose veins questionnaire

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Stretching in Enhancing Flexibility Following Burn Contracture in the Elbow: RCT – A Randomized Clinical Trial

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Burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction, or contact with chemicals. Contracture is a serious complication of burn, which occurs when the burn scar matures, preventing movement. Post-burn contracture is a major dilemma facing the burn management team. The study was conducted to investigate the best technique for increasing flexibility in post-burn contractures in the elbow joint. Sixty patients, aged 20 to 50 years, with decreased elbow flexibility due to contractures, were classified into two equal groups, with 30 patients in each group. Group A received the Muscle Energy Technique, and Group B received 20 seconds of Static Stretching with ultrasound as a baseline in both groups. Both groups were also given strengthening protocols. Measurements of elbow extension ROM were conducted before treatment and after treatment. Strength was measured by using a dynamometer before and after the treatment. It was a randomized clinical trial that used a convenience sampling technique, employing a goniometer and VAS as tools. The comparison of METs and Static Stretching on elbow movement at baseline and after 8 weeks of treatment has shown a significant difference, with a p-value of <0.005. Both the muscle energy technique and static stretching techniques were useful. Still, there was a significant difference between the two: METs are considered more effective in enhancing flexibility and improving pain among post-burn elbow contracture patients. The result was analyzed using SPSS version 27.

Keywords: Burn, Contractures, Elbow contracture, MET, Static stretching, Flexibility, ROM

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Effectiveness of Virtual Reality and Real Environment on Cognitive-Motor Training for Enhancing Cognitive and Motor Skills in Children with ASD

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Autism Spectrum Disorder (ASD) is a neurodevelopmental condition marked by difficulties with speech, social interaction, and repetitive behaviors. It is commonly linked with cognitive and motor skill dysfunctions, which negatively impact social characteristics and the general quality of life. Weakening of cognitive and motor skills is one of the most important issues faced by children with ASD. This study aims to compare how children with ASD utilize the real world versus virtual reality to enhance their cognitive, motor, and social skills. By exploring these two environments, one can better understand the potential benefits of virtual reality interventions in improving these abilities. This comparison could lead to new insights into how to support the development of children with ASD, ultimately enhancing their quality of life and social integration. Successful results from this study could position virtual reality rehabilitation as an effective tool for therapists and educators, leading to improved interventions and better outcomes for youngsters facing these challenges. A controlled, randomized experiment was conducted. Two groups of 38 people were selected, with one group receiving conventional therapy twice a week for four weeks. The results were assessed at baseline before treatment and after treatment. Results indicated that cognitive-motor skills in the virtual reality group improved significantly, from 0.53 ± 0.513 to 1.74 ± 0.452. For the control group, values reduced from 0.53 ± 0.513 to 1.32 ± 0.478. So, using a virtual reality head-mounted display device twice a week for four weeks demonstrated a significant improvement in cognitive-motor skills in children aged 3 to 7 years with ASD. The intervention group outperformed the conventional therapy group across all primary outcome measures. These improvements were sustained during the 4 weeks, indicating long-term functional benefits and the potential effect of the intervention.

Keywords: Autism spectrum disorder, Virtual reality, Cognition, Motor skills

Rehabilitation Sciences
Poster Presentations

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Prevalence of Sacroiliac Joint Dysfunction with Anterior Pelvic Tilt among Non-Specific Low Back Pain Patients

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This study explores sacroiliac joint dysfunction in non-specific low back patients with anterior pelvic tilt. A cross-sectional study was conducted after participants provided informed consent and were recruited through a purposive sampling technique, upon fulfilling the inclusion criteria. Participants were recruited from Madinah Teaching Hospital (MTH) and evaluated for anterior pelvic tilt using an inclinometer, sacroiliac joint dysfunction using standard provocation tests, and functional disability using the Oswestry Disability Index (ODI). A self-fabricated pelvic inclinometer, specifically designed and calibrated for this study, was utilized to enhance the precision and reliability of pelvic tilt measurements. Data were analyzed using SPSS version 23. Among 271 individuals diagnosed with non-specific low back pain, 36.9% demonstrated sacroiliac joint dysfunction. Moderate to severe anterior pelvic tilt was prevalent and exhibited a significant association with both pain intensity and functional disability. Participants presenting with sacroiliac joint dysfunction reported markedly elevated pain levels, underscoring a strong interrelation between pelvic alignment abnormalities, joint dysfunction, and the manifestation of low back pain symptoms. The findings revealed that individuals concurrently experiencing sacroiliac joint dysfunction and anterior pelvic tilt exhibited substantially elevated ODI scores, indicating pronounced impairments in daily functional capacity and a diminished quality of life.

Keywords: Sacroiliac joint, Non-specific low back pain, ODI, Anterior pelvic tilt, NPRS

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Evaluation of the Extent of Integration of Evidence-Based Practice among Physiotherapists in Lahore: A Survey Study

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Evidence-based practice (EBP) has become a cornerstone of modern physiotherapy by promoting clinical decisions based on scientific evidence, clinical expertise, and patient values. However, its integration into everyday clinical work remains inconsistent in developing regions. This study aimed to evaluate the extent of EBP integration among physiotherapists in Lahore, Pakistan, and to identify factors influencing its implementation. A cross-sectional descriptive survey was conducted among 160 physiotherapists using a modified Evidence-Based Practice Questionnaire. The questionnaire assessed attitudes, knowledge, skills, access to resources, and barriers to EBP on a 6-point Likert scale. Composite scores were calculated to estimate the likelihood of EBP integration, categorized from very unlikely (0–9) to strong likelihood (34–40). Data were analyzed using descriptive statistics. Almost all participants (98.8%) agreed that EBP is essential for clinical practice; however, notable gaps were observed in EBP-related knowledge and application skills. Commonly reported barriers included insufficient time, limited access to databases, and inadequate training in critical appraisal. Based on composite scoring, only 18.8% of physiotherapists demonstrated a strong likelihood of routinely applying EBP in clinical practice. Physiotherapists in Lahore highly value the concept of EBP but face substantial challenges in its consistent implementation. Focused interventions such as continuing education, improved access to research resources, and supportive institutional policies are recommended to enhance EBP integration. Building upon these findings, developing digital platforms or applications that help physiotherapists assess and monitor the evidence-based nature of their practice could further facilitate the translation of EBP into routine decision-making.

Keywords: Evidence-based practice, Physiotherapy, Barriers, EBP questionnaire

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Exploring the Benefits of Artificial Intelligence Integration in Physical Therapy Practice

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The purpose of this study is to explore the advantages of integrating artificial intelligence (AI) tools into physical therapy for improving assessment, diagnosis, and rehabilitation outcomes. This paper highlights how AI-based systems have enhanced the precision, efficiency, and personalization of physiotherapeutic care. The integration of artificial intelligence (AI) into physical therapy has transformed traditional clinical approaches by enabling data-driven, personalized rehabilitation. One of the most promising applications is in postural evaluation and gait analysis, where AI-powered systems such as DARI Motion, Simi Motion, and Kaia Health use computer vision and machine learning to analyze movement patterns in real time. These tools detect postural deviations, gait asymmetry, and biomechanical inefficiencies, helping therapists design more objective and individualized treatment plans. AI has also been integrated with electromyography (EMG) technology to interpret muscle activity patterns more accurately than conventional methods. AI-enhanced EMG analysis tools like Biometrics DataLINK and Noraxon MyoResearch use advanced algorithms to identify muscle fatigue, activation timing, and coordination deficits, enabling clinicians to make faster and more evidence-based therapeutic decisions. Similarly, AI-supported gas analyzers, such as COSMED VO_2 Master Analyzer and Pnoe System, help optimize exercise prescriptions by predicting aerobic capacity, monitoring recovery, and tailoring programs to each patient's physiological response. Beyond these clinical applications, AI-driven decision-support systems such as PhysiAI and Microsoft Health Bot assist therapists by analyzing patient data to predict recovery trends, reduce diagnostic errors, and improve treatment accuracy. Overall, integrating AI tools into physical therapy offers significant benefits, including objective assessment, personalized rehabilitation, and improved decision-making.

Keywords: Artificial intelligence, Physical therapy, DARI motion, Kaia health, EMG, VO_2 Max, Rehabilitation, Machine learning

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Comparative Effects of Graston Technique versus Local Ischemic Compression on Trigger Points of Pectoralis Major and Minor among Pseudo angina Patients

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Pseudo-angina refers to chest pain that resembles angina pectoris, a cardiac-related condition, but actually arises from musculoskeletal sources such as myofascial trigger points in the chest and neck muscles. The purpose of this study was to compare the effects of the Graston Technique and Local Ischemic Compression on trigger points in the pectoralis major and minor muscles among pseudo-angina patients. A total of 36 diagnosed patients with pseudo-angina were selected from the Physiotherapy Departments of Aziz Fatima Hospital and Faisal Hospital, Faisalabad. Cardiologists referred all patients after ruling out cardiac causes of chest pain. Participants were randomly allocated into two groups (n = 18 each) using the chit-and-draw method. Group A received treatment using the Graston Technique while Group B received Local Ischemic Compression along with baseline treatment of a Z stretch of the pectoralis Major and Minor muscles. Both groups underwent two treatment sessions per week for four consecutive weeks, along with baseline care. The effectiveness of both interventions was evaluated using the Numerical Pain Rating Scale (NPRS) for pain intensity, a universal Goniometer to measure shoulder range of motion (flexion, abduction, and external rotation), and the Shoulder Pain and Disability Index (SPADI) to assess functional limitation. Data were analyzed using SPSS version 25, and tests for normality were performed to determine the appropriate statistical analysis. The results demonstrated significant improvements in pain reduction, range of motion, and functional performance in both groups; however, the Graston Technique group showed greater reductions in pain than the Local Ischemic Compression group. In conclusion, the Graston Technique proved more effective at alleviating pain and improving shoulder function in patients with pseudo-angina. This study suggests that incorporating the Graston Technique in physiotherapy management can provide faster and more substantial relief in musculoskeletal chest pain resembling angina.

Keywords: Pseudo-angina, Trigger points, Pectoralis major and minor, Graston technique, Local ischemic compression

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Comparative Effects of Mulligan Mobilization with and Without Eldoa On Pain And Disability In Patients With Disc Prolapse- Induced Low Back Pain

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Low back pain is a common condition that affects the lower back's muscles, nerves, and bones. It can range from a dull ache to a sharp, sudden pain. The ELDOAs (Étirements Longitudinaux avec Decoaptation Ostéo- Articulaire) are postural self-normalizing procedures that aim to increase the space within a selected articulation. To achieve this, fascial tension is created to fix the vertebra below, and contraction in the extreme range is used to normalize the vertebra above the disc of interest. A manual therapy technique in which a patient makes a precise, active movement while a continuous, painless, passive glide is applied to a joint. This research was conducted to compare the effectiveness of Mulligan Mobilization with and without ELDOA in relieving pain and disability in patients with low back pain due to disc protrusion (L4-L5, L5-S1All the subjects were randomly assigned to two groups using the Goldfish bowl Method. The consecutive sampling method was used to collect data. CPT, Mulligan Mobilization, and ELDOA exercises were applied to Group A, while only Mulligan Mobilization and CPT were used in Group B. For a total of eight sessions in a month, each group attended two sessions per week. Pain intensity was assessed using the NPRS, whereas disability was assessed using the MODI. Data analysis was conducted using the Statistical Package of the Social Sciences (SPSS) version 27. Within-group comparison, mean difference between pre- and post-treatment values for NPRS and MODI in Group A was 2.45 ± 1.03 and 9.54 ± 5.94, whereas for Group B, it was 0.42 ± 0.52 and 3.58 ± 5.09, respectively. Between-group comparison: the p-values for NPRS and MODI were 0.026 and 0.085, respectively. The paired-samples effect sizes were calculated for both intervention groups using Cohen's d and Hedges' correction. In group A for NPRS and MODI, Cohen's d was 1.036 and 5.93, indicating large effect sizes. In group B, for NPRS, the Cohen's d was 0.515, indicating a moderate effect size, whereas for MODI, the Cohen's d was 5.089, indicating a very large effect size. It was concluded that Mulligan Mobilization with ELDOA is more effective in treating pain and disability in patients with disc prolapse-induced low back pain.

Keywords: Mulligan mobilization, ELDOA, Disc prolapse, Low back pain, Disability

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Prevalence of Plantar Fasciitis and Its Association with Foot Arches among Waiters in Restaurants of Faisalabad

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Plantar fasciitis is a common foot condition characterized by inflammation of the plantar fascia, the tissue connecting the heel to the toes. It typically causes sharp pain near the heel, especially with the first steps in the morning or after prolonged inactivity. To find the prevalence of plantar fasciitis in servers at restaurants in Faisalabad and its association with foot arches. The study was a cross-sectional, purposive sampling study conducted on 218 waiters (n=218) at well-known restaurants in Faisalabad. An interview questionnaire was used to collect socio-demographic data and a history of heel pain and its associated disability. To confirm the diagnosis and assess foot arches, special tests, such as the windlass test, were performed. The analysis was conducted using SPSS. About 92 of 216 participants tested positive for windlass, and signs and symptoms of plantar fasciitis were evident. The prevalence of plantar fasciitis among servers was 42.6%. There was a significant association between plantar fasciitis and foot arch type (p=0.017), which is below the p=0.05 threshold. The study concludes that plantar fasciitis has a notable prevalence and is significantly associated with foot arch type.

Keywords: Plantar fasciitis, Foot arch type, Flat foot, Restaurant workers, Musculoskeletal disorders

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