The University of Faisalabad

Presents

4th International Conference on Advanced

STEAM

Education

ICASE-2026

STEAM For Future-Ready Societies

ABSTRACT BOOK

(ISBN: 978-969-7767-03-8)



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4th International Conference on Advanced STEAM Education ICASE-2026 | STEAM For Future-Ready Societies

4th International Session on Advanced STEAM Education

STEAM for Future-Ready Societies (ICASE-2026)

ABSTRACT BOOK

(ISBN: 978-969-7767-03-8)

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- Aman Ullah Malik

The University of Faisalabad, Pakistan

Chairman's Message



It is a pleasure to welcome the distinguished scholars, researchers, educators, policymakers, industry professionals and students participating in the 4th International Conference on Advanced STEAM Education (ICASE-2026) at The University of Faisalabad.

The successful organization of the previous three ICASE conferences has established this event as an important academic activity of the University. This year's theme, "STEAM for Future-Ready Societies," is particularly relevant at a time when rapid advances in technology are changing the way we learn, work and live. Preparing our young people for this changing world requires more than technical knowledge. It calls for creativity, critical thinking, ethical judgment, problem-solving skills and the ability to work across disciplines. I am pleased to note that ICASE-2026 addresses these dimensions through a wide range of themes covering artificial intelligence and digital transformation, future skills, sustainability and climate action, entrepreneurship, educational technology, equity and well-being, arts and creativity, governance, smart healthcare, and Islamic perspectives.

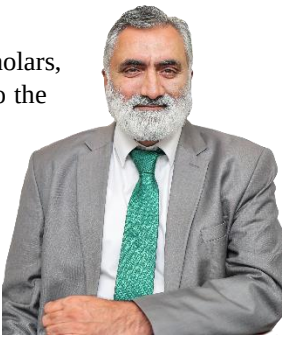
I hope the conference will provide an opportunity for participants to share their research and experiences, exchange ideas and establish new academic and professional collaborations. The diversity of speakers and topics in the technical programme reflects the University's commitment to encouraging dialogue across disciplines and connecting academic knowledge with the needs of society.

I appreciate the efforts of the Rector, the organizing committee, faculty members, staff and students of The University of Faisalabad who have worked to make this conference possible. I also extend my sincere appreciation to all the speakers and participants whose presence has added value to this event.

I wish ICASE-2026 a successful and productive conference and hope that the discussions and ideas shared here will contribute to preparing our young generation for the opportunities and challenges ahead.

Dr Muhammad Haider Amin
Chairman, Board of Governors
The University of Faisalabad

Rector's Message



It gives me great pleasure to welcome our national and international scholars, researchers, educators, policymakers, industry professionals and students to the 4th International Conference on Advanced STEAM Education (ICASE-2026) at The University of Faisalabad.

We are pleased to continue the ICASE series for the fourth consecutive year. The theme of this year's conference, "STEAM for Future-Ready Societies," reflects an important challenge before universities today: how to equip our students with the knowledge, skills and values they will need in a rapidly changing world.

Science and technology are advancing at an extraordinary pace, but technology alone cannot provide all the answers to the challenges facing our societies. We need people who can think creatively, understand different perspectives, work with others and use new technologies responsibly. This is where the integration of Science, Technology, Engineering, Arts and Mathematics becomes particularly meaningful.

The programme of ICASE-2026 brings together a broad range of subjects and perspectives, including future skills, artificial intelligence and intelligent learning, sustainability, entrepreneurship and industry linkages, educational technology and ethics, inclusion and well-being, arts and creativity, governance, smart healthcare and Islamic perspectives on future-ready societies. The technical sessions and keynote presentations provide an opportunity to explore these issues from both academic and practical perspectives.

At The University of Faisalabad, we believe that education should enable our students not only to understand the world around them but also to contribute to improving it. Research, innovation, creativity and collaboration are therefore important parts of our academic mission. Conferences such as ICASE give our faculty and students an opportunity to engage with colleagues from other institutions and to learn from ideas and experiences beyond their own disciplines.

I would like to acknowledge the efforts of the organizing committee, faculty members, staff and students who have contributed to the organization of this conference. I am equally grateful to all the keynote and invited speakers, researchers and participants for sharing their knowledge and joining us at The University of Faisalabad.

I hope that ICASE-2026 will be an enjoyable and intellectually rewarding experience for all participants and that the discussions initiated here will lead to new ideas, collaborations and opportunities.

I wish the conference every success.

Prof Dr Aman Ullah Malik
Rector
The University of Faisalabad


THE GLOBAL GOALS
For Sustainable Development
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS

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FUTURE SKILLS AND COMPETENCIES FOR THE 21ST CENTURY

ORAL

PRESENTATIONS

Topic of Invited Speech: "Future Skills and Competencies for the 21st Century"

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Rapid advances in artificial intelligence, automation, digital technologies and globalization are transforming the nature of work and challenging traditional models of higher education. In this environment, universities can no longer define graduate preparedness primarily in terms of disciplinary knowledge or technical proficiency. Future-ready graduates will require a broader combination of cognitive, technological, interpersonal and ethical competencies. This invited talk identifies seven interconnected competencies essential for the twenty-first century: lifelong learning and adaptability; critical thinking and judgment; AI and digital literacy; creativity and interdisciplinary problem-solving; communication and collaboration; ethical reasoning; and resilience and human agency. It argues that the growing capabilities of artificial intelligence make distinctly human capacities—judgment, curiosity, creativity, empathy, ethical responsibility and the ability to formulate meaningful questions—more rather than less important. The presentation also considers the implications for universities and educators. Developing future-ready graduates requires movement beyond predominantly content-driven and examination-centered education toward active, interdisciplinary, problem-based and experiential learning; stronger university-industry and community engagement; and assessment practices that emphasize application, analysis, creativity and judgment. With particular reference to South Asia's large youth population, the talk argues that higher education must prepare young people not merely to adapt to technological and economic change, but to become active creators of knowledge, innovation and social solutions. Ultimately, future-ready education must unite technological competence with human judgment.

Keywords: Skills with wisdom, technology with humanity, and knowledge with responsibility.

Future-Proofing Architectural Education: A Conceptual Framework Integrating Maqasid Syariah for Value-Infused Talent

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Educators form the cornerstone of national transformation, tasked with preparing future-proof talent capable of navigating the profound technological and cultural disruptions of Industry 4.0 and Artificial Intelligence. In complex, design-driven disciplines like architecture—a core pillar of integrated STEAM education—technical proficiency alone is insufficient to address complex sustainability challenges. To ensure graduates prioritize societal well-being, higher education must embed robust humanistic and spiritual values alongside technological capability. This keynote presents the foundational insights of an ongoing 3-year research project dedicated to cultivating *value-infused, future-proof talents* who are adept at filtering rapid technological advancements while embodying the principles of ethical stewardship (*khalifah*) grounded in *Maqasid Syariah* in Architectural Education. Focusing on Year 1 findings, this address examines a qualitative comparative policy analysis evaluating major international and national architectural accreditation benchmarks—including the Union of International Architects (UIA) standards, national higher education roadmaps, and domestic accreditation codes (PAAP)—against the core tenets of *Maqasid Syariah*. Initial results reveal critical policy gaps, notably a structural over-emphasis on technical competency at the expense of holistic socio-ethical safeguards. To address these vulnerabilities, this session outlines the proposed integrative curriculum framework, offering a visionary and adaptable roadmap for future-ready higher education across emerging and global STEAM landscapes.

Keywords: Architectural education, STEAM education, Value-infused talent, IR 4.0, Accreditation policy, *Khalifah*

Beyond Digitalization: Reimagining Education for a Just and Sustainable Future

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The growing presence of technology in education has generated considerable optimism about its potential to improve access, enhance learning, and prepare students for the future. Yet the availability of digital devices does not, by itself, transform education. When technology is introduced without revisiting the aims of education, classroom practices, curricula, and assessment systems, it may merely place new tools in the service of old pedagogies. More importantly, in unequal societies, technology may reinforce existing social and educational disparities rather than reduce them. This paper argues that the debate must move beyond digitalization to the more fundamental question of how education itself can be reimagined. Drawing on the human-centred vision of Society 5.0, it examines the relationship between technology, educational justice, and sustainable development, with particular reference to Pakistan. Technology can widen access to learning, create more interactive educational experiences, support marginalized communities, and help students develop critical thinking, creativity, ethical reasoning, and problem-solving skills. Its potential, however, is shaped by the social and institutional conditions in which it is used. The digital divide, inadequate infrastructure, limited teacher preparation, cultural mismatch, data privacy, and an excessive faith in technological solutions remain serious concerns. The paper places teachers at the heart of educational transformation and highlights the need for continuing professional development. It also calls for curricula that move beyond rote learning and encourage inquiry, creativity, interdisciplinarity, and critical consciousness. Digital content must be relevant to local languages and cultural contexts, while public policy must address inclusion, ethical governance, accountability, and sustainability. The real challenge, therefore, is not simply to digitalize education but to ensure that technology contributes to a more humane, equitable, and sustainable future.

Keywords: Educational transformation, Society 5.0, Equity, Curriculum reform, Sustainable development

Keep the Inner Child Alive: Reimagining Higher Education Learning in the 21st Century

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I would like to structure this talk on a humanistic note rather than dwelling on conventional pedagogical concerns and techniques designed to achieve success as an educationist. I argue that in today's highly charged educational environment replete with challenges to maintain a balance between technological innovation and human potential, sustainability and corporate mentality, our aim should not only be to produce more knowledgeable and technically successful graduates but to make efforts to preserve and cultivate curiosity and a sense of wonder, playfulness, and imaginative spaces, which are considered specific to children. Roughly speaking, three out of every ten Pakistanis are children; however, unfortunately we not only fail to learn from this huge populace but also kill our 'inner child' to become a part of a complex process of development in which we gradually adjust ourselves to certain modes of knowing, behaving, and succeeding in our lives and professions. Drawing from Peter Gray's recent work on curiosity, Johan Huizinga's proposition about homo ludens, the playing human, and Donald Winnicott's concept of transitional space, I reiterate that keeping our inner child is tantamount to preserving and cultivating human dispositions of curiosity, imagination, and playfulness, that facilitate learning throughout the lifespan.

Keywords: Inner child, Curiosity, Playfulness, Imaginative spaces

Beyond the Canon: English Studies 2.0 in the Digital Age

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The advent of artificial intelligence (AI), along with the rapid expansion of digital media and networked cultures, is having a profound impact on the practices, scope, and nature of English Studies. Traditionally, English Studies has taken pride in canonical literary texts, largely print-based scholarship, and well-established philosophical and interpretive frameworks. However, the discipline is now undergoing a significant transformation into what may be termed English Studies 2.0. This transformation has generated new forms of literary and cultural inquiry that are more inclusive, interdisciplinary, and technologically mediated. The AI-driven development of English Studies suggests moving beyond the traditional canon, not by abandoning literary traditions, but by rethinking what constitutes a text, the agency it affords, and the ways in which meaning is produced in contemporary digital environments. English Studies 2.0 further signals the expansion of literary and cultural studies beyond poetry, drama, and the novel to include digital narratives, social media, blogs, podcasts, films, memes, gaming cultures, and AI-generated texts. Consequently, the authority traditionally attributed to the author is being challenged, while the fixed boundaries between writer, reader, and text are becoming increasingly blurred. These developments necessitate critical engagement with questions of authorship, originality, intellectual property, algorithmic bias, academic integrity, and the future role of human interpretation. This paper argues that the future of English Studies lies not in choosing between the humanistic and the technological, but in developing a productive dialogue between the two. English Studies can thus remain deeply humanistic while responding meaningfully to the rapidly changing cultural and technological realities of the 21st century.

Keywords: English studies 2.0, Digital humanities, Artificial intelligence, Literary canon, Digital culture

Exploring University Teachers' ICT Skill Needs: A Qualitative Inquiry Using the Technology Acceptance Model

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Information and Communication Technology (ICT) has become central to teaching and learning in higher education, yet its effective use depends largely on teachers' skills, confidence, and institutional support. This qualitative study explored the ICT skill needs of university teachers at the University of Sargodha, Pakistan, using the Technology Acceptance Model (perceived usefulness and perceived ease of use) as a sensitizing framework. Data were collected through open-ended questionnaires, semi-structured interviews with teachers of varying ICT proficiency across departments, and a focus group discussion on online distance learning (ODL) and emerging technologies such as generative AI. Reflexive thematic analysis was used to identify patterns across the data. Participants generally viewed ICT as valuable for student engagement, access to resources, and interactive learning. However, they described uneven ICT literacy, limited technical and pedagogical integration skills, and a gap between recognizing the importance of ICT and feeling able to use it. Teachers said that technical skills made ICT easier to use, while pedagogical and innovative use increased its perceived usefulness. Cyber risk awareness and self-efficacy also shaped their willingness to adopt it. Barriers included inadequate training, the digital divide, weak infrastructure, difficulties with online assessment and academic integrity, student motivation, over-reliance on technology, and ethical concerns about AI. The study concludes that professional development should be continuous and should combine technical, pedagogical, and ethical competencies, backed by institutional leadership and infrastructure investment.

Keywords: ICT skills, Technology acceptance model, Qualitative research, Professional development, Future skills

Learning by Doing: A Practitioner's Case for Activity-Based Pedagogy in STEAM Education

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Future-ready societies need learners who can think critically, adapt quickly, and solve problems in situations they have not faced before, i.e. abilities that matter even more in the emerging AI era, where routine and memory-based tasks are increasingly handled by machines/algorithms. Yet across many levels of education, from vocational diplomas to postgraduate programs, teaching still relies heavily on memorization rather than building these real and transferable competencies. Based on 27 years of teaching, training, and field experience at master's, undergraduate, diploma, and vocational levels, this paper makes a case for activity-based pedagogy as a practical way to prepare learners for this future. The paper shares practical examples from the author's own teaching, where group workshops, peer-learning tasks, and hands-on problem-solving activities helped students move from passive listening and memorizing toward actively thinking, discussing, and applying knowledge in new scenarios. These methods, tried across different levels of learners, showed clear improvement in subject understanding as well as in critical thinking, communication, teamwork, adaptability, and early leadership qualities; the kind of holistic competencies future-ready societies and workplaces will demand. The paper also discusses common challenges in applying activity-based methods, such as limited time, difficulty in assessment, and the need for trained facilitators, along with practical ways to manage these challenges based on direct experience. By sharing a field-tested and practical approach, this paper aims to support educators and institutions seeking to align teaching with the skills and competencies needed for an AI-driven, future-ready world. The core message is simple: students build lasting ability not by remembering more, but by doing, discussing, and solving problems together.

Keywords: Activity-based learning, Peer-learning, Future skills and competencies, Critical thinking, STEAM pedagogy

AI-Enhanced STEAM Learning and Students' Future-Ready Competencies in Higher Education

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AI is changing higher education and opening up new possibilities for interactive, personal, and interdisciplinary learning. Implementing AI into Science, Technology, Engineering, Arts, and Mathematics (STEAM) education offers students the chance to use AI in science to be creative, fostering skills in competence and technology for the ever-evolving academic and professional landscape. The study focused on the future-ready competencies of higher education students and their linkage with AI-enhanced STEAM learning. This is a quantitative research approach, with a cross-sectional survey design. A structured questionnaire with the objective of capturing the measures of AI-enhanced STEAM learning and future-ready competencies was used with undergraduate students to collect the data. The study variables were summarized using descriptive statistics and the relationship and predictive contribution of the use of AI-enhanced STEAM learning on students' future-ready competencies were established through Pearson correlation and regression analyses. The analysis showed there was a connection between the use of AI in STEAM learning and students' future-ready competencies, and it was positive. The students who had been exposed to higher levels of AI-supported and interdisciplinary STEAM learning also exhibited higher levels of critical thinking, creativity, problem-solving, digital literacy, collaboration, and innovativeness. The regression results also suggested that STEAM learning with the enhanced ability of AI played a significant contribution to creating students' future-ready competencies. AI use in STEAM learning environments holds the potential to bridge gaps between traditional learning methods and foster interdisciplinary connectivity of knowledge, creativity, engagement with technology, and thinking of a higher order. The study presents a positive assessment of the potential of AI-enhanced STEAM learning to address the new student training requirements in higher education institutions and reinforces the importance of universities strategically implementing AI-based interdisciplinary learning into the curriculum.

Keywords: Artificial Intelligence, Higher Education, Interdisciplinary Learning, Digital Literacy, Critical Thinking

From Campus to Market: Exploring the University–Industry Gap in Student Entrepreneurship in Pakistan

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This study aims to examine whether entrepreneurship and university–industry opportunities established within Pakistan's higher education system are accessible to students and effective in supporting their transition from academic ideas to practical market opportunities. This study focuses primarily on students' experiences, awareness, and perceived access to entrepreneurship education, industry connections, and commercialization support since 21st century knowledge-based economy has high demands of such skills. A quantitative, cross-sectional and multidisciplinary methodology has been adopted using a structured questionnaire as the primary source of data from undergraduate students in major universities in Faisalabad studying Software Engineering, Computer Science, Artificial Intelligence, Information Technology, and Business administration. The secondary sources include closely related studies examining university-industry collaboration, student employability, and entrepreneurial spheres. Prior research suggests that collaboration between Pakistani universities and industries faces coordination and structural challenges, while internships, entrepreneurship education, and university support can influence students' entrepreneurial development. Prior studies emphasize the complexities of student venture creation and the importance of accessible support structures. However, this study mainly assesses the students' experiences of accessing and using these existing opportunities. The study is limited geographically to major universities in Faisalabad and to the selected disciplines, meaning its findings may not represent students across all universities, disciplines, or regions of Pakistan. The study is expected to be significant as it explores the students' perspectives rather than focusing on the mere existence of institutional platforms. Its findings are intended to identify the major barriers between campus-based ideas and market opportunities, providing a basis for strengthening entrepreneurship support for university students.

Keywords: Student Entrepreneurship, Employability, University support, Student innovation, commercialization

Contemporary Literary Studies and Global Competencies: Navigating Identity Construction in Post-Digital Literature

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This study analyzes how identity construction is comprehensively reformulated within post-digital literature and substantiates how this progression requires a new prototype of global competencies within contemporary literary studies. Moving to the early high technological and systematical passion of cyberculture, the post-digital state act as a cultural moment where digital universality is standardized. Contemporary narratives progressively exist in a hybrid space that seamlessly mix variant traditions with network aesthetics, algorithmic mediation, interactive formats, and code-based textuality. Therefore, this medium-level transition fundamentally modifies and alters how literature portray selfhood, cultural belonging, individual agency and performance in an age defined by continual connectivity. By linking contemporary literary theory with established global competency frameworks particularly in intercultural empathy, critical algorithmic literacy, digital citizenship and transnational mindfulness. This research emphasis the dynamic role of humanities education in a hyper-mediated world. As digital platforms erase traditional geographic borders post-digital texts imitate decentralized, fragmented and fluid identities that challenge conventional nation, state centered literary canons. Readers involve not simply as passive consumers of stories but as active participants navigating irregular, multi-platform and user-influenced narrative settings. Through a qualitative, interdisciplinary analysis of selected post-digital literary works this study examines how navigating complex digital textuality directly develops the cognitive and emotional flexibility required for 21st-century global citizenship. Eventually this research determinate that evaluating post-digital literature provides readers with necessary interpretive tools. It promotes critical awareness of how algorithms shape identity, intensify understanding across networked cultures and upgrade the capacity to deal with multi-layered identities in an interlinked, post-digital reality. Thus, the study reinforces the lasting relevance of literary scholarship as an important operator for developing global competency, media literacy, and ethical involvement in contemporary higher education.

Keywords: Algorithmic literacy, Global competencies, Identity construction, Post-digital literature

Tracing Ecological Imagination: A GIS-Based Literary Analysis of Real-World Landscapes in Powers' *The Overstory*

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This study develops a GIS-based literary analysis of Richard Powers' *The Overstory* by connecting its ecological imagination with measurable changes in real-world landscapes. The research investigates how forests, ecological interconnectedness, environmental degradation, and human impact represented in the novel can be examined through geospatial evidence. Drawing on Ecocritical perspectives associated with Lawrence Buell, Cheryll Glotfelty, Timothy Morton, and Rob Nixon, the study combines literary interpretation with Geographic Information Systems (GIS) and Remote Sensing techniques. Selected landscapes in California and Oregon are examined, while Costa Rica is included as a comparative study area. Sentinel-2, MODIS, CHIRPS, and Hansen Global Forest Change datasets are used to analyze Land Use/Land Cover, vegetation, precipitation, Land Surface Temperature, forest loss, and landscape fragmentation. The study further employs predictive modelling to investigate possible future land-use transformations. The findings indicate notable changes in forest cover, expansion of built-up areas, variation in precipitation, increased Land Surface Temperature, and continuing pressure on forest ecosystems. The classification assessment demonstrates high accuracy across the analyzed years, supporting the reliability of the LULC maps used for subsequent spatial analysis. The projected landscape patterns further indicate continued transformation of forest and agricultural areas. By bringing together literary analysis and geospatial methods, the study demonstrates that ecological themes in *The Overstory* can be examined not only as literary representations but also in relation to observable environmental processes. The research contributes an interdisciplinary framework connecting English Literature, Ecocriticism, GIS, Remote Sensing, and Environmental Humanities, and demonstrates the potential of spatial analysis to broaden the study of ecological imagination and real-world environmental change.

Keywords: Ecocriticism, GIS, Remote sensing, *The Overstory*, Environmental humanities

Generative AI and Emerging Digital Divide: The Role of AI Literacy Among Students

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Rapid advancement in Generative Artificial Intelligence (GenAI) is changing how female undergraduate students obtain information, study, communicate and carry out their academic work. However, these technologies may not benefit all students equally, especially when there are differences in AI literacy and ability to use AI tools effectively. This research aims to examine whether the rise of GenAI is creating a new digital divide among students based on their AI literacy and ability to use AI tools effectively. The objective is to assess students' AI literacy, evaluate their ability to use GenAI tools, and explore the relationship between these factors and differences in students' academic use of GenAI**.** Existing literature indicates that AI literacy involves technical skills, critical thinking, system awareness, and ethical understanding, while effective GenAI use can influence students' learning experiences. However, limited research has examined whether differences in these skills are contributing to a new digital divide among students beyond access to technology. To address this gap, this study adopts a quantitative research approach using a structured Google Forms survey distributed among female undergraduate students. This research will prove to be significant as it will examine whether differences in students' AI literacy and effective use of GenAI tools contribute to a new digital divide. By exploring students' AI literacy, their use of GenAI, and the relationship between these factors, this study may provide insights into emerging forms of digital inequality and support the development of targeted AI literacy training to strengthen future-ready skills and promote more equitable academic practices.

Keywords: Generative AI, AI literacy, Digital divide, AI skills, Effective AI tool use

Pharmacogenomics and AI-Driven Precision Medicine in Community Pharmacy

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Community pharmacies are one of the most accessible care settings in primary care, but the availability of traditional medicines is largely based on empirical basis, leading to adverse drug reactions (ADRs) and low effectiveness. Pharmacogenomics (PGx) and artificial intelligence (AI) can provide a chance to move community practice to more proactive, personalized pharmacotherapy. To assess the feasibility, workflow and translation challenges of implementation of AI-driven pharmacogenomic clinical decision support systems (CDSS) in community pharmacies. AI algorithms help to simplify the understanding of complex high throughput genomic variants along with variables that are not genetic like renal function, hepatic clearance, age, polypharmacy and drug-drug interactions. Predictive machine learning models can be integrated into the community pharmacy management system and allow pharmacists to quickly detect actionable gene-drug interactions (GDI) at the point of dispensing, like CYP2C19 with clopidogrel, CYP2D6 with psychotropics, or VKORC1/CYP2C9 with warfarin). But there are significant barriers to routine use, such as the cost of testing, genomic and health regulations that limit access to patient information, EHR interoperability, limited training in the community, and others. AI and pharmacogenomics transform community pharmacists from prescribers to active participants in precision medicine. To scale these technologies, overcome the challenges of health system integration and deploy them in a meaningful and ethical way, issues of reimbursement pathways and the complexities of implementing the technologies effectively and at scale with ambulatory populations must be addressed.

Keywords: Pharmacogenomics, Artificial intelligence, Precision medicine, Clinical decision support systems, Adverse drug reactions

Constructing Environmental Competencies for Sustainability: A Critical Discourse Analysis of Green Marketing Discourse

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This study aims to investigate how corporate language develops environmental awareness and transmits ideological meanings by critically analyzing Nestlé's slogan, "Reverse, Recycle, Reuse." To achieve this aim, the study has analyzed the slogan by employing Fairclough's three-dimensional model of eco-critical discourse principles including three levels; first is textual, then discursive, and then social practice. Textual level has emphasized imperative structure, repetition, and lexical choices. It looks at how the slogan has utilized Nestlé's marketing and sustainability discourse at the discursive level. And at the social-practice level, this study has analyzed broader social ideologies such as corporate environmentalism, responsibility of consumers, and green marketing strategies in relation to future-oriented skills and competencies in environmental responsibility and sustainability. The results show how simple but structured language has conveyed different intricate ecological and ideological meanings. Although the slogan has also encouraged green consciousness, along with placing responsibility on consumers and strengthening organizational branding. Moreover, this study has significantly contributed to green marketing discourse by highlighting the future-oriented skills and competencies in promoting environmental responsibility and sustainable marketing practices.

Keywords: Green marketing, Sustainability, Environmental responsibility, Eco-Critical discourse, Critical discourse analysis

Digital Identity and Critical Thinking in Dave Eggers *The Circle* (2013)

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The rapid evolution of digital technologies has transformed the ways individuals construct, negotiate, and communicate their identities in contemporary world. The research examines the complex relationship between tech-driven corporate environments, self-presentation and digital autonomy in a highly digital society. This research demonstrates how people navigate in the digital world. While existing studies on *The Circle* (2013) emphasize on the concept of surveillance, infiltration of personal boundaries and technological control, this research focus on digital identity as a competency-related issue. The novel portrays the story of Mae Holland, who joins the circle company and experiences the transparent digital environment for instance sharing data on digital platforms, online transparency, and social approval greatly influence her identity construction and critical thinking. This study examines the construction of digital identity and the significance of critical thinking in *The Circle* (2013) through Erving Goffman's (1959) Self-Presentation Theory. The study focuses on Mae Holland's increasing involvement with the Circle and examines how constant visibility and demands for online participation blur the boundaries between the front-stage performance and the back-stage reflection. It further considers how the pressure to maintain a desirable digital persona can limit independent reflection and critical engagement with technology. The findings demonstrate that uncritical acceptance of digital norms undermines independent judgment and reflective decision-making. Conclusively, this study emphasizes the development of digital awareness and, importantly, ethical decision-making in technologically mediated societies.

Keywords: Critical thinking, Self-Representation, Digital Autonomy, Corporate Environment, Digital Identity

Beyond the Subtext: A Post-Structuralist Critique of AI-Generated Adaptations of The Metamorphosis

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This study examines how AI-generated visual adaptations of Franz Kafka's *The Metamorphosis* interpret and represent the intrinsic textual ambiguities of the original novella. While Kafka's narrative deliberately leaves Gregor Samsa's transformation unexplained—maintaining a detached tone that permits infinite interpretations—generative AI platforms require these open-ended textual elements to be translated into concrete digital forms. Drawing on a Post-Structuralist framework informed by Roland Barthes's concept of the active reader generating plural meanings and Jacques Derrida's notions of *différance* and the instability of textuality, this paper employs qualitative visual analysis to evaluate a selected corpus of publicly available AI-generated visual content. The analysis investigates five primary narrative dimensions: the visual representation of Gregor's transformation, its implied cause, the family and labor dynamics, Kafka's detached narrative tone, and the ambiguity of the ending. This paper argues that while AI adaptations tend to collapse complex prose into specific visual choices, they do not entirely eliminate interpretive openness, as viewers actively question and re-read the meanings presented. By integrating literary theory with generative technology, this study fosters critical AI literacy by demonstrating how human critical engagement remains essential in automated media environments.

Keywords: Franz Kafka, Roland Barthes, Jacques Derrida, Visual interpretation, Critical AI literacy

Islamic Perspective on Digital Media, Misinformation, and Information Ethics in a Future-Ready Society

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Digital misinformation is changing how people understand truth, authority, and responsibility, and Muslim societies face the same challenge. This study examines tabayyun, the Quranic principle of verifying information before accepting or sharing it, as an ethical and intellectual response to misinformation in digital media. The study has three aims. It explains the basis of tabayyun in the Quran and Hadith, identifies the limits of digital literacy approaches that focus mainly on technical verification, and develops an Islamic framework for responsible engagement with online information. The study argues that misinformation is not only a technological problem, but also a problem of judgment, trust, and moral responsibility. For this reason, technical fact checking alone cannot fully address the way people form beliefs and respond to claims within religious communities. A qualitative library research method is used to examine Quranic verses, Hadith, classical Islamic reasoning, contemporary scholarship, and recent examples of online misinformation. The study finds that tabayyun can function as a practical discipline for protecting intellect, religion, and social trust. It concludes that Islamic information ethics can strengthen digital literacy, guide responsible use of artificial intelligence, and support a more thoughtful and accountable digital society. It also offers ethical guidance against algorithmic radicalization.

Keywords: Tabayyun, Digital Literacy, Islamic Information Ethics, Artificial Intelligence, Algorithmic Radicalization, Moral Responsibility

Ultrasound and Shear Wave Elastography Evaluation of Median and Tibial Nerves in Diabetes

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Diabetes mellitus has been shown to lead to structural and biomechanical changes of peripheral nerves. Peripheral nerves can be non-invasively interrogated with ultrasound to assess morphology. In addition, nerve stiffness can be quantified utilizing shear wave elastography (SWE). The purpose of this study was to assess the ultrasonographic and shear wave elastography characteristics of the median and tibial nerves in both diabetic and non-diabetic participants. A total of 130 participants were enrolled in the study including 65 diabetic participants and 65 non-diabetic controls. Bilateral median and tibial nerves were interrogated using ultrasound to determine nerve appearance and cross-sectional area (CSA). Additionally, SWE velocity (m/s) was collected and compared between groups. Independent samples t-tests were used to identify differences between groups. Chi-square and Fisher's tests were used to identify associations between diabetic and non-diabetic participant. Increased cross-sectional area, shear wave velocity and differences in nerve echogenicity of bilateral median and tibial nerves in participants was associated with diabetes. This study shows that traditional ultrasound along with shear wave elastography can detect structural and biomechanical differences in peripheral nerves that occur with diabetes and serve as useful complementary quantitative and morphological modalities for early detection of peripheral nerve changes.

Keywords: Median nerve, tibial nerve, ultrasonography, shear wave elastography

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FUTURE SKILLS AND COMPETENCIES FOR THE 21ST CENTURY

POSTER

PRESENTATIONS

Sonographic Evaluation of Fetal Fat Tissue, Heart, Liver and Umbilical Cord in Diabetic Pregnant Females

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Maternal diabetes is a common metabolic disorder during pregnancy that can significantly influence fetal growth, body composition, and organ development. Chronic maternal hyperglycemia promotes excessive fetal fat deposition and enlargement of fetal organs, increasing the risk of adverse maternal and neonatal outcomes. The objective of this study was to evaluate fetal fat tissue, heart, liver and umbilical cord in diabetic and non-diabetic pregnant females during 3rd trimester. A comparative case-control study was conducted among pregnant females in their third trimester. Participants were divided into diabetic and non-diabetic groups. Sonographic examination was performed to measure fetal biometric parameters, including biparietal diameter (BPD), head circumference (HC), abdominal circumference (AC), femur length (FL), estimated fetal weight (EFW), amniotic fluid index (AFI), fetal subcutaneous fat tissue thickness, liver length, cardiac dimensions, and umbilical cord diameter. Data were analyzed using SPSS version 26. Independent-samples t-test was applied to compare quantitative variables between the two groups, with a p-value of <0.05 considered statistically significant. Fetuses of diabetic mothers demonstrated significantly higher values for abdominal circumference, estimated fetal weight, amniotic fluid index, fetal fat tissue thickness, liver length, cardiac dimensions, and umbilical cord diameter compared with fetuses of non-diabetic mothers. Most of these differences were statistically significant ($p < 0.05$), indicating increased fetal adiposity, liver length, IVS thickness and umbilical cord diameter associated with maternal diabetes. The study concluded that fetal fat tissue, heart, liver and umbilical cord all these parameters are significantly increased in fetuses of diabetic pregnant females as compared to non-diabetic.

Keywords: Maternal diabetes, Gestational diabetes mellitus, Fetal fat tissue, Fetal liver, Fetal heart, Fetal biometry

Discursive Construction of Future-Oriented Decision-Making in the Netflix Series *Musafir Café*

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The study aims to analyze the discursive negotiation of future-oriented decision making in Netflix's Musafir Cafe focusing on the negotiation of characters' career aspirations, personal relationships, uncertainty and future choices. The study is based on a qualitative research design and Critical Discourse Analysis is used as research method by employing Fairclough's Three-Dimensional Model. Data for analysis has been selected for season one (eight episodes) and the dialogues have been chosen that are directly relevant to plans for the future, important decisions, job options, life goals and transitions. Selected dialogues are analyzed in terms of their formal and situational characteristics and patterns in the representation of future-oriented decision-making are revealed. The results have shown that future-oriented decisions are constructed through expressions of intention, possibility, obligation, and evaluation. For instance, modal verbs of possibility and obligation indicate uncertainty and perceived responsibility, and characters' references to planned actions and their own personal goals build decision making as a process of goal setting. Career opportunities and personal transitions are further negotiated and negotiated in the construction of decision-making in dialogues about careers and about personal changes. The results indicate that future-oriented decision-making is thus not only a matter of choice, but also one that is discursively negotiated, in which there is space for agency, uncertainty, responsibility, and interpersonal expectations. Moreover, the study's results significantly contribute to the media discourse by providing evidence of language use in the current stream narratives as a manifestation of the participation of people in possible futures and important life decisions.

Keywords: Decision-Making, Future Orientation, Discursive Construction, Media Discourse, Modality, Agency, Critical Discourse Analysis

AI-Generated Literacy and Literary Interpretation: Reimagining Humanistic Inquiry in the Age of Generative AI

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The rapid development of Generative Artificial Intelligence (GenAI) is transforming the production, interpretation, and teaching of literary texts. This study explores the concept of AI-generated literacy in literary studies and examines how GenAI influences literary interpretation while maintaining the interpretive role of the human reader. The study is theoretically informed by hermeneutics, reader-response theory, and critical approaches to digital humanities. Using a qualitative, interpretive, and text-based approach, it comparatively examines selected literary passages and AI-generated interpretations, focusing on contextual understanding, ambiguity, authorial intention, cultural specificity, and interpretive depth. The study proposes a framework based on three dimensions: structural critique, interpretative agency, and methodological hybridity. It argues that AI-generated literacy extends beyond technical proficiency and requires the ability to critically evaluate, interpret, contextualize, and ethically engage with AI-mediated literary knowledge.

Keywords: Hermeneutic, Algorithmic literacy, Critical interpretation

A Queer Analysis of Transgender Representation in Bol (2011)

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This synopsis proposed an interpretation of Bol (2011) as directed by Shoaib Mansoor as a critical inquiry on the cinematic representation of transgender identity, interpreted with the interpretive apparatus of queer theory. Drawing on Butler's theorization of gender performativity and on South Asian scholarship on the khwaja sira tradition the film's construction of Saifu, the main transgender character, and its intersections with patriarchy, religious orthodoxy and lower-middle-class urban precarity in Lahore were interrogated. The research questions focused on the following: Does Bol disrupted or rein scribed cis-heteronormative gender epistemologies and is Saifi's narrative are represented emancipatory queer visibility or functioned as an instrumentalization of transgender suffering for humanist critique using qualitative textual, semiotic and critical discourse analysis. The project addressed a missing point in Pakistani screen scholarship about queer readings from a local perspective and offered an epistemologically decolonial approach to the application of queer theory to non-Western cinematic contexts.

Keywords: Queer theory, Transgender representation, Pakistani cinema, Khwaja sira, Judith Butler;

Algorithmic Governance and the Politics of Social Control in Naomi Alderman's *The Future* (2023)

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This research paper examines the suffering of people when the power of ruling is in the hands of high-tech corporations and how the 21st century competencies are necessary to survive it. This study analyzes the novel Naomi Alderman's *The Future* (2023) through the lens of Michael Foucault's theory of governmentality that argues about the dominating power control in society shifting from government to corporations. In 21st century the world is destabilized due to technological advancement, and shifting of power dynamics, which demands future skills. The Future depicts a shift from state sovereignty towards the CEOs who wanted to govern the population through data, algorithms rather than laws. As in this novel power is governed by corporate logic but Martha was the only individual who understands the system from within and refuses to be self-govern showing the urgency of 21st century competencies such as critical thinking, problem solving, and digital literacy. This research highlights a future where tech CEOs have more power than the states. They don't force people to obey them, but they make people want to be governed by them. This study emphasizes people with less power might be the ones who can secure and fight back through their critical thinking and future skills. This research paper employs close reading method by I.A Richard to examine the Corporate's power structure and social control. This study interprets the novel through the perspective of corporate governance and social control. The significance of this research is to warn us about a future where corporations act as saviors and take population as product. The analysis highlights that future belongs to those who understand the system and resist self-governance. This research concludes that the focus is shifted from the relationship between human and technology towards a future where technology is acting as a bridge between humans and mega corporations making digital competencies essential for survival.

Keywords: Governmentality, Critical thinking, Corporate logic, Digital literacy, Algorithm

A Pragmatic Analysis of Accountability in Zohran Mamdani's 100-Days Address

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The study aims to analyze the pragmatic construction of governmental accountability in Zohran Mamdani's 100-Days Address, focusing on how the speech represents completed governmental actions, future commitments, and shared responsibility. The study is based on a qualitative research design and uses Speech Act Theory as the research framework, drawing on Austin's (1962) theory and Searle's (1969) classification of illocutionary acts. Data for analysis has been selected from the official transcript of the address, delivered on 12 April 2026 and published by the New York City Mayor's Office. The selected speech acts are examined in their linguistic and pragmatic contexts to identify patterns in the construction of governmental delivery and future responsibility. The findings show that assertives are used to present completed actions through references to what the administration has "done" and "delivered," while commissives construct future responsibility through recurring "we will" expressions. The use of the collective pronoun "we" further represents governmental action and commitment as shared responsibility. The findings indicate that accountability is constructed through a connection between reporting past actions and committing to future action, allowing governmental delivery to serve as a basis for further commitments. The study demonstrates that political language does not simply communicate information about governance; it also constructs relationships of responsibility between political leadership and citizens. The study therefore contributes to political pragmatics by showing how speech acts can reveal the linguistic construction of accountability and provide greater awareness of how public communication shapes citizens' understanding of governmental action and responsibility.

Keywords: Speech Act Theory, Political pragmatics, Assertives, Commissives, Pragmatics of Accountability

Code-Switching as a Multilingual Competency: A Linguistic Analysis of Netflix Series *Never Have I Ever*

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This study aims to examine English–Hindi code-switching in the Netflix series *Never Have I Ever* and explore its role in multilingual communication. It focuses on how characters alternate between English and Hindi across different conversational situations and the communicative functions served by these switches. The study adopts a qualitative linguistic approach and analyzes a purposively selected sample of 30 English–Hindi code-switching instances from the series. Poplack's (1980) model is used to classify these instances as inter-sentential, intra-sentential, and tag switching. The findings show that code-switching occurs purposefully, particularly for expressing emotions, adding emphasis, creating humor, maintaining cultural references, and responding to different interlocutors. Intra-sentential switching is also found to incorporate Hindi expressions naturally into predominantly English conversations. These patterns demonstrate how speakers draw on both languages according to their communicative needs and interactional contexts. The significance of the study lies in presenting code-switching as a multilingual communicative resource rather than simply an alternation between languages. By examining English–Hindi interaction in a contemporary Netflix series, the study highlights the role of flexible language use in multilingual communication and its relevance to developing competencies needed in linguistically diverse contexts. The study concludes that code-switching enables multilingual speakers to manage meaning, emotion, and cultural expression through context-sensitive language choices.

Keywords: Code-switching, Multilingual communicative competency, Bilingual interaction, Multilingual discourse

Social Learning and Criminal Behaviour in John Fowles' *The Collector*

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John Fowles' The Collector (1963) presents the abduction and imprisonment of Miranda Grey by Frederick Clegg and provides insight into the ways individuals perceive, interpret, and respond to their social environment. This study examines the development and representation of Clegg's criminal behaviour through Albert Bandura's Social Learning Theory (1977), which explains behaviour in relation to observation, social interaction, environmental influences, and individual cognitive processes. The study employs a qualitative textual analysis based on close reading of selected passages, dialogues, thoughts, and interactions involving Clegg and Miranda. The analysis focuses on how Clegg's social experiences, observations, personal perceptions, and interactions contribute to his understanding of relationships and influence his behavioural choices. Particular attention is given to the contrast between Clegg's perception of his actions and Miranda's experience of them, highlighting the role of social context and individual interpretation in the construction of behaviour. The study argues that Fowles represents criminal behaviour as a complex interaction between individual perceptions and social and environmental influences rather than as an isolated act. Beyond its literary and psychological significance, the study connects the analysis to the development of 21st-century competencies, particularly social awareness, critical thinking, ethical reasoning, and perspective-taking. By encouraging readers to examine behaviour from multiple perspectives and to question the relationship between personal interpretation, social influence, and ethical responsibility, the study demonstrates how literary analysis can contribute to competencies required for navigating complex social and ethical situations in the 21st century.

Keywords: The Collector, Albert Bandura, Social Learning Theory, Criminal Behaviour, Social Awareness, Critical Thinking, 21st-Century Competencies.

AI-Driven Surveillance and Digital Panopticon: A Foucauldian Analysis of Ctrl (2024)

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AI has become an important part of communication and information management in people's everyday lives. As technology becomes increasingly important, people need to understand the nature of AI and the ways in which it can influence human behaviour and digital interactions. The current paper aims to examine the relationship between AI, surveillance, and human control through the analysis of the CTRL (2024) film. Michel Foucault's concept of Panopticism serves as the theoretical framework, with key concepts including surveillance, visibility, observation, and control. The paper discusses existing research on the film and examines how AI based systems can influence individuals through continuous observation and digital visibility. Qualitative thematic analysis is used to examine CTRL as a fictional representation of AI driven surveillance and control. The study explores how the possibility of constant observation can affect human behaviour and autonomy within digital environments. By applying Foucault's concept of Panopticism to CTRL, this study highlights how AI and digital technologies can create new forms of surveillance and influence over individuals. The results demonstrate that the film portrays AI surveillance as an ongoing process that leaves individuals feeling observed and influences their decision-making. The data shows
that people are progressively losing privacy and autonomy due to digital visibility, while control is becoming more fragmented and difficult to identify effectively. In addition, the study discovers that the film suggests tech as an element that shapes choices, relationships, and public life. The paper concludes that CTRL warns about the risks of AI surveillance and promotes the values of privacy, awareness, and accountability in using modern technology.

Keywords: Artificial intelligence, Surveillance, Cybersecurity, Panopticism, CTRL

Exploring AI Companionship and Human–AI Intimacy in the Netflix Series *My Holo Love*

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The rapid development of Artificial Intelligence (AI) has created new forms of interaction between humans and AI systems. This study examines the development of human–AI intimacy and emotional attachment through the relationship between Han So-yeon and Holo, the AI hologram, in the Netflix series My Holo Love. So-yeon, who lives a relatively isolated life, begins to interact with Holo and gradually develops an emotional connection with him. The study focuses on how communication, self-disclosure, personalized interaction, and emotional support contribute to this developing relationship. It uses qualitative textual analysis of selected dialogues and situations from the series. Social Penetration Theory (Altman and Taylor, 1973) and Attachment Theory (Bowlby, 1969/1982; Ainsworth et al., 1978) are used to examine the development of intimacy, self-disclosure, and emotional attachment between So-yeon and Holo. The analysis shows that regular communication and increasing personal disclosure gradually strengthen So-yeon's emotional connection with Holo. The study also shows how the series presents an AI companion as a source of communication, understanding, and emotional support. Overall, My Holo Love presents AI companionship as more than a technological interaction, showing how communication, self-disclosure, and emotional support can shape a meaningful sense of intimacy and attachment between a human and an artificial agent.

Keywords: Artificial intelligence, AI companionship, Human–AI intimacy, Emotional attachment, Self-disclosure,

Female Agency and Future Competencies in Veselka's *The Great Offshore Grounds*

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This study examines women's negotiation of patriarchal structures, relational constraints, and uncertain social futures. The aim of the research is to analyse how acts of resistance, self-definition, and relational negotiation challenge normative constructions of femininity. Existing literary discussions focus on interpreting the novel primarily through the perspective of family, displacement, identity, and interpersonal relationships, this research is significant because is focus on gender performativity as a process through which female agency intersects with the development of future-oriented human capacities. Drawing on **Judith Butler's (1990) theory of** gender performativity the study analyses Vanessa Veselka's *The Great Offshore Grounds* (2020) The novel portray that female agency is strongly connected with resilience and adaptability. By connecting Butlerian (1990) feminist theory with the discourse of 21st-century competencies, the research offers a contemporary reading of women's agency as an ongoing process of negotiating, resisting, and reconfiguring normative structures. It further argues that Veselka's representation of women foregrounds agency not simply as individual resistance but as a dynamic capacity to rethink identities, relationships, and social possibilities within changing environments. The analysis reveals that *The Great Offshore Grounds* presents female agency as a negotiated and continually reconstructed process rather than a fixed personal attribute. The study concludes that *The Great Offshore Grounds* offers a significant representation of female agency as a continuous process of negotiating, resisting, and reconfiguring gender norms.

Keyword: Resistance, Feminist agency, Performativity, Resilience

Exploring Changing Notions of Femininity in the Netflix Series *Anne with an E*

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This study explores the construction of female value through the contrasting dynamics of physical beauty and intellectual ability in the Netflix series *Anne with an E* (2017 to 2019). The core objective of the study is to explore the negotiation between aesthetic expectations and intellectual self-worth through the character of Anne. Through a qualitative analysis of the series, this study examines the reduction of female worth to physical attractiveness by presenting intelligence, language, education and ambition as alternative forms of value and how beauty standards remain psychologically powerful. This study utilizes Sandra Bem's Gender Schema Theory discussed in her book *The Lenses of Gender: Transforming the Debate on Sexual Inequality* (1993) to showcase how people develop culturally shaped ideas about what is appropriate or desirable for males and females. The analysis focuses on the protagonist, Anne Shirley , who initially internalizes traditional beauty. Grounded in feminist empowerment, she utilizes her rich vocabulary, strength, imaginative storytelling and academic ambition to redefine her identity. Ultimately, the study has demonstrated that *Anne with an E* subverts conventional gender expectations by proving that intellectual capital offers a more sustainable, empowering and authentic foundation for female self-worth than physical beauty.

Keywords: Female identity, Beauty standards, Intellectual identity, Gender schema theory, Female representation

Designing for Digital Well-Being: Exploring How App Features Affect University Students' Self-Control

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Social media platforms have now become a major part of university students' daily lives, helping them communicate, connect, and access information. However, specific app design features, such as notifications, likes, comments, and continuous scrolling, often create a constant urge to check phones. This behavior can lead to the phenomenon of fear of missing out (FOMO) and negative scrolling habits that harm students' study routines and self-regulation. Previous research mostly focuses on the psychological and behavioral aspects of social media use. Minute attention has been given to how specific user interface (UI) and software design choices directly influence user engagement from a Human–Computer Interaction (HCI) perspective. This study aims to fill that gap by examining how specific interface features relate to student engagement and self-control. Using a quantitative, cross-sectional design, data will be collected through a structured questionnaire distributed to university students. The collected responses will be analyzed to identify patterns between software features, social engagement, and self-regulation. The findings will improve understanding of digital well-being by providing a clear, software-focused view of social media engagement.

Keywords: Social media, Self-regulation, Interface designs, Social engagement, Human computer interaction

The Society of the Spectacle: Examining the Replacement of Reality with Representations in Lockwood's *No One Is Talking About This*

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This research analyzes Patricia Lockwood's novel *No one is talking about this* (2021) through Guy Debord's theory "The Society of the Spectacle" which provides a strong framework to deeply explore the life of the protagonist who is a social media influencer. By employing Debord's theory, this article affirms that unnecessary presence on digital platforms causes disconnection from reality and creates a distorted sense of identity, causing the erosion of meaningful life through trends, memes and likes. Qualitative research approach, particularly close reading method has been used to conduct this study, exploring the alarming situation of digital culture where authenticity is being deteriorated and genuine human experiences are being replaced by mere representations. The study aims to scrutinize the harmful outcomes of sharing personal everyday life on social media constantly and how it replaces society-based on real emotions and connections with society of spectacle. By conducting research on Lockwood's *No one is talking about this*, this study contributes to the contemporary debates about negative consequences of digital life which prioritizes appearances over reality, emphasizing that the hashtag life consumes individuality and creates the illusion of meaning, leaving the person trapped in images.

Keywords: Society of spectacle, Digital life, Appearance over reality, Screens, Social media

Constructing the Human Self in Iqbal's *Bang-e-Dra*: A Gadamerian Hermeneutic Inquiry into Spiritual Consciousness

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This research proposes a Gadamerian hermeneutic inquiry into spiritual consciousness. It offers philosophical and literary investigation into construction of human self (Khudi) in the poetry of Allama Muhammad Iqbal, focusing on the seminal Urdu collection of Bang-e Dara. This Study shall undertake a flavor of Gadamerian hermeneutics reinterpreting Iqbal's concept of Khudi as it works keeping the keen eye on the self -given and constructed by Iqbal. Research gap of the study is the hermeneutic analysis that treats individuality as a dynamic site of meaning-making between the reader and the historical horizon of the self. This research draws on the distinctive insights of Hans-Georg Gadamer's philosophical hermeneutics to examine the reconstruction of the self through linguistic craft, metaphorical expression, and dialogical engagement between text and reader, concept of ''fusion of horizons'', and "play", in addition to "historically effected consciousness'' "Wirkungsgeschichtliches Bewusstsein". This investigation utilizes a text based qualitative research methodological approach using Gadamer's analysis. This disquisition delimits Iqbal's Bang-e Dara, "Parinday ki Faryad", "Insan", "Shikwa", "Jawab-e-Shikwa", "Naya Shivala", "Tulu-e-Islam" the past of the text and the present of the reader are considered in the fusion of horizons "Wirkungsgeschichtliches Bewusstsein. This research analyzes Bang- e-Dara as a post-colonial context, its textual horizon of the poetic structure and contemporary horizon of modern reader hypothesizing that Khudi is not fixed or static. This research argues that as Iqbal is inspired from the west, he proposed his own concept of Khudi offering a dynamic model for understanding Islamic modernism. In crux, Khudi in Bang-e-Dara is an active, evolving hermeneutic event. Leaving research gap for researchers this research contributes to postcolonial literary studies demonstrating how post-colonial indigenous philosophical texts can be reinterpreted through western hermeneutic, which fosters a cross-cultural academic dialogue and offers a fresh pedagogical approach to Iqbal's work in contemporary literary curricula.

Keywords: Bang-e-Dara, Gadamer, Hermeneutics, Khudi, Fusion of Horizons, Postcolonial Literature

Technology and Reconfiguration of Authorship in the 21st Century: A Barthesian Reading of Ishiguro's *Klara and the Sun*

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The rapid development of Artificial Intelligence (AI) has transformed traditional understandings of creativity, originality, and authorship. Kazuo Ishiguro's *Klara and the Sun* (2021) presents an artificial friend, Klara, whose capacity to observe, learn, and form emotional connections raises important questions about who and what can be considered an author or creative agent in a technologically mediated world. The study examines the reconfiguration of authorship in the 21st century through Roland Barthes (1967) concept of the Death of the Author. Using a qualitative textual analysis the research explores how Klara challenges the conventional human-centered understanding of creativity, intention, and agency. The study focuses on the relationship between technological mediation and human creativity and the production of meaning in the novel. It argues that Klara offers a space for understanding authorship as a relational and distributed process rather than an exclusively human act. The research contributes to contemporary literary discussions concerning AI, authorship, creativity, and the boundaries between artificial agency and human creativity. Research further investigates how technological systems influence the interpretation of meaning and distribution of creative authority. Through Klara's perceptions, observations and interactions with human characters, the novel complicates the distinction between creator, creation and the interpreter. A Basthesian perspective allows the study to move beyond the idea of authorship as the sole product of an individual human consciousness and instead consider how meaning emerges through relationship among readers, texts, technologies and cultural context. By examining these dimensions, the study highlights the way in which Klara and Sun reflects changing concepts creativity, creation and agency in an increasingly technological society.

Keywords: Artificial intelligence, Roland Barthes, Death of the author, Artificial Agency, Human–AI relations, Literary theory

Creative Resilience and Alienation in Donna Tartt's *The Goldfinch*

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In an increasingly complex and emotionally demanding world, resilience, adaptability, creativity, and emotional endurance have become significant capacities for navigating twenty-first-century challenges. While literature frequently represents trauma, loss, and alienation, the role of creativity as a means of psychological resilience and identity reconstruction remains comparatively underexplored. This study examines Donna Tartt's postmodern novel The Goldfinch (2013) to investigate how art mediates psychological disruption and enables creative resilience within a fragmented contemporary world. Employing close textual analysis through the lens of postmodern literary theory, the study focuses on Theo Decker and his enduring attachment to a stolen painting following a devastating personal loss. The analysis demonstrates that the painting transcends its status as an aesthetic object, functioning as a source of meaning, emotional continuity, and psychological endurance as Theo confronts grief, instability, alienation, and a fractured sense of identity. His sustained engagement with art emerges not as mere escapism but as an active process of coping, meaning-making, and identity reconstruction. The findings suggest that creativity can operate as a human capacity for negotiating disruption and sustaining emotional resilience, connecting literary representations of art with contemporary understandings of adaptability, imagination, and emotional competence. Beyond its literary significance, the study highlights the potential of creative engagement to contribute to capacities increasingly valued in twenty-first-century life, including resilience, adaptive thinking, imagination, and emotional endurance. Ultimately, The Goldfinch positions art not merely as an aesthetic experience but as a potential means of psychological endurance and human resilience in an emotionally fragmented world.

Keywords: Postmodern fiction, Psychological endurance, Identity reconstruction, Creativity

Spatial Imagination and Human-Centered Futures in Samit Basu's *The City Inside* (2022)

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Contemporary fiction increasingly presents urban spaces as dynamic systems, and not merely as settings for human action, that actively shape perception, identity, social interaction, and possibilities for the future. While existing studies primarily interpret literary spaces as representations of identity, memory, power, or social relations, comparatively less attention has been given to how contemporary fiction constructs space as an active, creative, and human-centered system. This research examines Samit Basu's *The City Inside* (2022) for how its technologically mediated urban environment reconfigures human experience and imagines the conditions of a future-ready or future-oriented society. The study utilizes Henri Lefebvre's Production of Space (1974), particularly the concepts of spatial practice, representations of space, and representational spaces as its major theoretical framework. The research analyses how technologically designed urban spaces shape human perception, identity formation, mobility, and social interaction, by using this framework. It argues that Basu's futuristic city functions as an active social and cultural system that both enables and constrains human possibilities, rather than simply a technological environment. By foregrounding the relationship between spatial design, technology, and human capabilities, the study demonstrates how contemporary fiction can imagine alternative models of urban life in which technological advancement is negotiated through human needs and social relationships. The research contributes to literary studies by extending spatial analysis toward questions of future skills, human-centered innovation, and the imaginative construction of future societies.

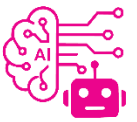
Keywords: Literary space, Spatial imagination, Human-centered innovation, Future-ready societies, Urban futures

Postmodern Disillusionment in the Digital Age: A Cross-Genre Study of Hamid's *The Last White Man*

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This paper explores the theme of postmodern disillusionment within the digital age, analyzing how the complexities of a hyperreal, fragmented, and disillusioned society are represented in Mohsin Hamid's *The Last White Man*. Guided by Gilles Deleuze and Félix Guattari's *Rhizomatic Theory* the study examines how the novel portrays a society steeped in the fluidity, uncertainty, and multiplicity characteristic of the digital age. Rhizomatic Theory offers a framework for understanding the novel's depiction of reality and identity as fragmented and endless shifting. Through textual analysis, this study argues that Hamid's novel encapsulates a postmodern society profoundly reliant on information technology and a utopian vision of digital and scientific progress. The protagonists, Anders and Oona, are profoundly affected by this interconnected web of technology and misinformation. The narrative illustrates how a rhizomatic structure of knowledge and information undermines traditional anchors, producing a world defined by virtual experiences, consumerism, and a lack of social cohesion. In this light, *The Last White Man* reflects a society where information technologies contribute to a postmodern condition of instability and cultural erosion. By focusing on the broader implications of rhizomatic networks in shaping digital-age disillusionment, this study offers recommendations for future research on how these structures impact modern identity and societal coherence.

Keywords: Postmodern disillusionment, Digital culture, Hyperreality, Fragmented identity, Information technology



ARTIFICIAL INTELLIGENCE, INTELLIGENT LEARNING, AND DIGITAL TRANSFORMATION

ORAL PRESENTATIONS

Metaheuristic-Driven Optimization Approaches to Strengthen Cybersecurity and Intrusion Detection

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The convergence of intelligent technologies such as the Internet of Things (IoT), Internet of Vehicles (IoV), Internet of Unmanned Aerial Vehicles (IoUAVs), and smart power grids has transformed modern infrastructures into highly interconnected ecosystems. This integration enables real-time data exchange, automation, and improved efficiency across sectors such as transportation, energy, and critical infrastructure. However, the rapid growth of these systems has also introduced complex cybersecurity challenges, exposing them to evolving threats that can disrupt essential services and compromise data integrity. This seminar explores the role of metaheuristic-driven optimization approaches in strengthening cybersecurity and enhancing intrusion detection within these environments. Metaheuristic algorithms such as Particle Swarm Optimization, Genetic Algorithms, and Grey Wolf Optimization are presented as effective tools for optimizing resource allocation, feature selection, and model parameters in distributed and dynamic settings. When combined with advanced deep learning frameworks, including Deep Transfer Learning, Convolutional Neural Networks, and ensemble models, these methods enable faster learning, adaptive decision-making, and robust detection of malicious activities. The seminar further discusses their application across diverse domains, including edge-based intrusion detection in IoUAV systems, secure task management in multi-access edge computing, hybrid learning in IoV environments, and explainable feature selection for smart power grids. Together, these approaches highlight how metaheuristic optimization provides an intelligent and scalable foundation for developing resilient cybersecurity solutions capable of safeguarding next-generation cyber-physical systems against increasingly sophisticated threats.

Keywords: Metaheuristic optimization, Cybersecurity, Intrusion detection, Deep learning, Cyber-physical systems

Intelligent Healthcare: How AI Is Transforming Diagnosis, Treatment and Patient Outcomes

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Artificial intelligence (AI) is transforming healthcare by introducing new approaches to disease diagnosis, clinical decision support, medical imaging, drug discovery, and personalised treatment. Advances in machine learning, deep learning, generative AI, and multimodal data analysis enable healthcare systems to extract meaningful insights from complex medical data, support early disease detection, and assist clinicians in making informed decisions. This keynote will explore the evolving role of AI in healthcare, highlighting its applications in precision medicine, disease prediction, biomedical research, remote patient monitoring, and intelligent clinical systems. It will also address key challenges in translating AI innovations into clinical practice, including data privacy, algorithmic bias, model interpretability, data quality, regulatory compliance, and clinical reliability. Particular attention will be given to human–AI collaboration, responsible implementation, and rigorous validation to ensure safe, equitable, and clinically meaningful outcomes. The keynote will conclude by highlighting emerging research opportunities and the importance of interdisciplinary collaboration in advancing AI-driven healthcare.

Keywords: Artificial intelligence in healthcare, Precision medicine, Clinical decision Support, Medical imaging

From Engineering to Innovation: Transforming STEAM Education for an AI-Driven Future

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The rapid acceleration of Artificial Intelligence (AI) and advanced engineering technologies is fundamentally reshaping the global workforce, demanding a radical paradigm shift in how we educate and prepare the next generation. This keynote explores the vital journey From Engineering to Innovation: Transforming STEAM (Science, Technology, Engineering, Arts, and Mathematics) Education for an AI-Driven Future. As conventional educational frameworks struggle to keep pace with autonomous systems, machine learning, and smart sensor applications, educators and institutional leaders must pivot toward dynamic, cross-disciplinary ecosystems that merge core engineering principles with creative problem-solving and AI literacy. Drawing from extensive academic research, practical engineering applications, ranging from wearable health rehabilitation systems to automated purity classification frameworks and institutional leadership experiences, this presentation highlights how real-world technological innovations can be directly translated into impactful pedagogical models. Engineering is no longer confined to isolated technical problem-solving; it serves as the foundational backbone for driving holistic innovation. By embedding advanced tools like machine learning algorithms, intelligent sensors, and practical research methodologies into the curriculum, we can cultivate students who are not merely tech consumers, but active creators and innovators. Furthermore, this keynote addresses the critical competencies required to bridge the gap between academic research and industry demands. It examines strategies for empowering students and researchers through robust proposal writing, interdisciplinary collaboration, and high-impact project execution. Ultimately, transforming STEAM education for an AI-driven future requires visionary leadership, resilient research frameworks, and a commitment to nurturing holistic talent. This address provides academic leaders, educators, and industry professionals with a comprehensive roadmap to inspire the next generation of engineers and innovators to lead with purpose, creativity, and technical excellence.

Keynote: Science, Technology, Engineering, Arts, Mathematics, AI

Numerical Investigation and ANN-Based Prediction of MHD Casson Nanofluid Flow over a Moving Thin Needle

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This study investigates the flow, heat transfer, and nanoparticle concentration of a Casson nanofluid moving over a thin needle in the presence of a magnetic field. The mathematical model considers important effects such as the Casson fluid behavior, Brownian motion, thermophoresis, heat transfer, and nanoparticle diffusion. The governing equations for fluid flow, temperature, and nanoparticle concentration are transformed into a system of nonlinear ordinary differential equations using suitable similarity transformations. The resulting equations are solved numerically to examine how different physical parameters affect the velocity, temperature, and concentration profiles. To further improve the analysis, an artificial neural network (ANN) model is developed using the numerical results as input data. The ANN is trained, validated, and tested to learn the relationship between the governing physical parameters and the corresponding flow and heat/mass transfer characteristics. Its predictions are then compared with the numerical solutions to evaluate the accuracy of the proposed machine-learning approach. Statistical measures, including mean squared error (MSE), root mean squared error (RMSE), mean absolute error (MAE), and coefficient of determination (R^2), are used to assess the performance of the ANN model. The study aims to provide a clear understanding of the effects of the controlling parameters on the flow, temperature, and concentration fields and to demonstrate the usefulness of artificial neural networks for predicting the numerical results. The proposed numerical–ANN framework can reduce computational effort and provide a fast and reliable way to estimate the behavior of complex nanofluid flow systems. This combined approach links numerical modelling with data-driven prediction of the flow and transport characteristics.

Keywords: Casson nanofluid, Magnetohydrodynamics, Artificial neural networks, Heat transfer, Thin needle

Artificial Intelligence in Big Data Management in Modern Corporations

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Corporations now generate data at volumes and speeds that exceed the capacity of conventional data-management tools, and artificial intelligence (AI) is increasingly presented as the means of converting that data into decisions. This paper examines published evidence on how AI supports big data management in modern corporations and how adoption differs across regions. A convergent mixed-method design based entirely on secondary data was used. The qualitative strand applied reflexive thematic analysis to a purposive corpus of 23 scholarly works and 16 institutional or press documents, drawn mainly from 2016 to 2026. The quantitative strand descriptively compared adoption indicators published by Eurostat, the OECD, McKinsey & Company, the Stanford AI Index, and national sources in Singapore and Japan. The share of organizations reporting AI use in at least one business function rose from 55% in 2023 to 88% in 2025 in McKinsey's global survey, whereas 20.0% of European Union enterprises with ten or more employees used AI in 2025, ranging from 5.2% in Romania to 42.0% in Denmark. Six themes emerged: decision-quality gains, dependence on organizational capability, data quality and governance, human and managerial readiness, regulatory and ethical constraint, and contextual divergence. Evidence from Pakistan shows that perceived benefits and top management support predict adoption intention more strongly than infrastructure alone, while no nationally representative enterprise statistic comparable to Eurostat's was located. The paper concludes that AI is now widely used but rarely scaled, that headline adoption figures are not comparable across sources, and that capability building and governance, rather than technology acquisition, determine value.

Keywords: Artificial intelligence, Big data management, Corporate AI adoption, Data governance, Regional differences

An Efficient Attention-Gated Hybrid Transformer-CNN Framework for Plant Disease Segmentation In-the-Wild

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Plant disease segmentation in field images is challenging because lesions may have indistinct boundaries, backgrounds are complex, and disease classes are imbalanced. This study presents a hybrid deep learning framework that combines convolutional and transformer-based representations for automated plant disease mapping. A ResNet-50 convolutional branch captures local spatial detail, while a SegFormer Vision Transformer stream models long-range semantic context. The architecture integrates an Atrous Spatial Pyramid Pooling (ASPP) context bridge for multi-scale feature extraction and a Cross-Scale Multimodal Attention Gate (CMAG) for combining complementary representations. These components are designed to suppress background noise while retaining information about subtle lesion boundaries. A dynamic phase-weighted loss function addresses class imbalance and supports optimization of boundary precision. The framework is evaluated on the PlantSeg dataset, where it achieves a mean intersection over union of 67.81% and an F1-score of 80.82%, with 55.8 million parameters. The reported comparison indicates improved segmentation performance relative to the CNN and transformer-based models considered in the study. The results support the use of complementary local and global features for identifying plant disease regions under challenging imaging conditions. The framework's contribution lies in combining multi-scale contextual processing, attention-based feature integration, and an imbalance-aware learning objective within one segmentation architecture. This combination links the extraction of fine lesion detail with broader visual context in agricultural scenes. The study concludes that the proposed architecture offers a basis for automated plant disease segmentation and precision agriculture applications. Deployment on resource-constrained edge devices and real-time use remain application goals that require evaluation under the intended hardware and operating conditions.

Keywords: Plant disease segmentation, Hybrid deep learning, ResNet-50, SegFormer, Attention mechanisms

Exploring the Influence of Generative AI on the Development of Management Competencies Among Gen Z Students

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Generative Artificial Intelligence (Gen AI) is increasingly influencing higher education and the competencies students need for future workplaces. This study explored Gen Z university students' experiences and perceptions of using Gen AI in relation to the development of management competencies. It considered both the perceived contributions of these tools and students' concerns about their use in academic learning. A qualitative phenomenological design was employed to examine participants' experiences. Semi-structured interviews were conducted with 30 BS students from universities in Sialkot, Pakistan, selected through purposive sampling. The interview data were analysed thematically to identify patterns in students' accounts of Gen AI use and its perceived relationship with management competency development. The findings showed that participants viewed Gen AI as an academic support partner contributing to problem-solving, decision-making, communication, teamwork, leadership and initiative, and strategic thinking and planning. Problem-solving, communication, decision-making, and planning were particularly prominent in their accounts. Leadership development appeared more indirect, with participants describing increased confidence and initiative rather than direct leadership development. Participants also expressed concerns about excessive dependence on AI tools. They emphasized the importance of critically evaluating and verifying AI-generated information while maintaining independent judgment. These findings suggest that responsible and purposeful use of Gen AI may complement students' management competency development. As the study examines students' perceptions, its findings describe perceived contributions rather than independently measured improvements in competencies. Universities may integrate structured and ethically guided Gen AI practices into teaching and learning, combining opportunities for competency development with an emphasis on critical thinking, verification, and independent decision-making.

Keywords: Generative artificial intelligence (Gen AI), Management competencies, Gen Z students, Higher education, Competency development

Exploring Teachers' Experiences with ChatGPT in Higher Education

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The emergence of generative artificial intelligence (AI), especially ChatGPT, has created new opportunities for teaching and learning in higher education. It has also raised concerns regarding student dependency, critical thinking, and the accuracy of AI-generated information. This study examined university teachers' perceived benefits and challenges regarding the use of ChatGPT in teaching and learning and explored their experiences of using this technology. A convergent parallel mixed-methods design was employed. In the quantitative phase, data were collected from 60 university teachers through a questionnaire on a five-point Likert scale. The questionnaire comprised items measuring the benefits of using ChatGPT and perceived challenges. Descriptive statistics, including frequencies, percentages, means, and standard deviations, along with a t-test, were used to analyze the quantitative data. In the qualitative phase, 12 university teachers were purposively selected for semi-structured interviews. The qualitative data were analyzed using thematic analysis. The findings showed that teachers perceived ChatGPT as a valuable tool, particularly for supporting access to information, lesson planning, and exposure to diverse perspectives. However, teachers expressed concerns regarding students' reliance on AI-generated responses, particularly the potential impact of ChatGPT on critical thinking, problem-solving, and understanding of subject matter. The qualitative findings further provided insights into teachers' experiences and the ways they addressed these perceived benefits and challenges. Overall, the findings suggest that university teachers recognize both the potential and limitations of ChatGPT, highlighting the importance of responsible use, appropriate guidance, and careful integration of AI into higher education. The study considers these findings in relation to teachers' reported experiences of integrating ChatGPT into educational practice.

Keywords: ChatGPT, Generative AI, Higher education, University teachers, Teaching and learning

DeepScan Urdu: Cross-Modal Attention for Audio-Visual Deepfake Detection in Low-Resource Urdu

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Audio-visual deepfakes present a detection challenge for low-resource languages, including Urdu, where suitable datasets and language-specific evaluations remain limited. This study introduces DeepScan Urdu, a cross-modal attention approach for detecting manipulated Urdu video content. A dataset of 230 Urdu video segments was created, comprising 120 authentic recordings and 110 synthetic segments. Synthetic material was generated using four neural text-to-speech voices, with Wav2Lip used to produce corresponding lip movements. The model adapts the attention mechanism of the AVFF architecture so that audio features act as queries and visual features provide keys and values. This design enables interactions between the two modalities within the detection process. Evaluation included a held-out test set, five-fold cross-validation, and modality ablation experiments. On the held-out test set, the model achieved 94.3% accuracy, a ROC-AUC of 98.4%, and precision and recall of 93.8%. The reported cross-validation result was 86.5% ± 10.9%, indicating substantial variability across folds. A comparison with simple feature concatenation was also conducted to examine the contribution of the cross-modal attention mechanism to the overall detection performance of DeepScan Urdu. Audio and video ablation experiments were used to examine the contribution of each modality. The system is being deployed through a FastAPI service, with a reported processing time of approximately 18 milliseconds per clip on a Tesla T4. The findings suggest that cross-modal modelling is promising for Urdu deepfake detection, while the small dataset and variation across validation folds limit conclusions about generalization. Further evaluation on larger and independent Urdu datasets is needed to establish the robustness of the approach.

Keywords: Audio-visual deepfake detection, Wav2Lip, Multimodal learning, Low-resource languages, Urdu

FairEdge-FL: A Fairness-Aware, Institutional-Heterogeneity-Driven Aggregation Framework for Privacy-Preserving Federated Learning in Smart Educational Systems

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Federated learning enables educational institutions to train intelligent tutoring and learning analytics models collaboratively without sharing raw student data. However, conventional aggregation methods such as FedAvg weight client contributions by local data volume, potentially marginalising institutions with fewer resources. This study proposes FairEdge-FL, a fairness-aware aggregation framework that accounts for institutional heterogeneity. Aggregation weights incorporate data volume, real-time computational capacity, and a static institutional equity score. The framework also includes a variance-regularised training objective and an equity-boost correction mechanism. The study provides a mathematical formulation and a specified aggregation algorithm, with comparisons against FedAvg and FedProx. Evaluation uses a synthetic educational task across eight seeds with paired significance testing, followed by validation on the UCI Student Performance dataset and a hyperparameter ablation study. In the reported synthetic evaluation, FairEdge-FL achieved the strongest equity performance among the compared approaches. The global accuracy comparison was not statistically significant ($p = 0.498$, $n = 8$), and the reported fairness-gap comparison also did not reach the conventional 0.05 significance threshold ($p = 0.077$, $n = 8$). These results indicate a promising equity pattern but do not establish statistical equivalence in accuracy or a statistically significant fairness improvement. On the real-world dataset, fairness gains were not readily apparent, with class imbalance and rapid model convergence identified as limitations. The study therefore supports further investigation of institution-aware aggregation while acknowledging the limits of the current empirical evidence. Larger-scale evaluations and additional significance testing are needed to assess whether the observed equity pattern generalises across educational settings. FairEdge-FL offers a framework for examining educational equity alongside predictive performance in decentralised learning.

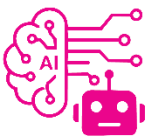
Keywords: Federated learning, Fairness-aware aggregation, Smart education, Educational equity, Institutional heterogeneity

The Algorithm as the New Ministry of Truth: Generative AI, Synthetic Media and the Literalisation of Dystopian Prophecy in George Orwell's Nineteen Eighty-Four

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This study examines the contemporary relevance of George Orwell's Nineteen Eighty-Four (1984) through generative artificial intelligence (AI) and synthetic media. It focuses on the novel's Ministry of Truth, which controls information, alters historical records, distributes propaganda, and shapes public understandings of reality. The research asks how these fictional practices illuminate forms of information production and control associated with algorithms, AI-generated content, deepfakes, and synthetic images and videos. Using a comparative literary approach informed by Michel Foucault's ideas of power, surveillance, and control, the study reads Orwell's representation of truth manipulation alongside contemporary digital systems. The analysis considers how information can influence what people see, believe, remember, and share, and how technological mediation can complicate the distinction between authentic and fabricated content. It argues that generative AI creates possibilities for information control as well as new forms of communication. A central distinction concerns the organisation of power: Orwell depicts a fictional ministry, whereas contemporary influence may operate through platforms, algorithms, automated processes, and extensive collections of user data. The comparison therefore identifies thematic parallels without treating present-day systems as an exact reproduction of Orwell's imagined state. The study finds that synthetic media gives renewed relevance to the novel's concerns about historical memory, surveillance, propaganda, and the manipulation of truth. Its contribution lies in connecting literary dystopia with questions about algorithmically mediated knowledge and belief. The study concludes that Orwell's warning retains critical force in the age of AI, while its contemporary interpretation requires attention to the dispersed technological systems through which information is generated, circulated, and encountered.

Keywords: George Orwell, Generative AI, Algorithms, Ministry of Truth, Synthetic media



ARTIFICIAL INTELLIGENCE, INTELLIGENT LEARNING, AND DIGITAL TRANSFORMATION

POSTER

PRESENTATIONS

AI-Driven Intelligent Learning and Digital Transformation in STEAM Education: A Mixed-Methods Study

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Artificial intelligence (AI) is reshaping education through intelligent learning systems and institutional digital transformation. This study examines the role of AI tools in teaching, learning, and institutional effectiveness within STEAM education. It combines a systematic literature review following PRISMA guidelines with a quantitative survey of 100 teachers, students, and administrators. This design brings together published research and participant responses to examine AI integration and educational outcomes from complementary sources of evidence. Survey analysis included Cronbach's alpha, correlation, regression, and analysis of variance (ANOVA). Cronbach's alpha was used to assess internal consistency, while the other analyses examined relationships among the study variables. The reported reliability coefficients exceeded 0.70. The findings indicated a strong positive correlation between AI integration and learning outcomes. Regression analysis also identified digital transformation as a significant factor associated with academic performance. These findings suggest that AI-driven platforms can support personalised learning, student engagement, and institutional preparedness for technological change. The inclusion of teachers, students, and administrators situates the investigation across teaching, learning, and organisational roles within education. Integrating the literature review with survey evidence provides a basis for practical guidance on AI adoption in STEAM settings. The study contributes a framework intended to help educators and policymakers connect intelligent learning practices with broader institutional transformation. It concludes that AI integration and digital transformation should be considered together when planning educational improvement. The reported associations support attention to personalisation, engagement, and organisational readiness as connected aspects of implementation, while the combined review and survey approach offers a structure for further investigation of AI-supported educational change.

Keywords: Artificial intelligence, Intelligent learning, Digital transformation, STEAM education

Artificial Intelligence in Education: Transforming Intelligent Learning for Future-Ready Students

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Artificial Intelligence (AI) is increasingly transforming educational practices by enabling personalized learning, intelligent feedback, automated assessment and data-driven decision-making. However, the rapid adoption of AI in education also requires learning environments that effectively combine technological innovation with critical thinking, creativity, digital literacy and responsible use of emerging technologies. This study explores the potential of AI-enabled intelligent learning systems to support digital transformation in higher education and prepare students for the demands of future workplaces. A conceptual and exploratory approach is adopted through an examination of existing literature and emerging developments in artificial intelligence, adaptive learning, generative AI, learning analytics and digital education. The study focuses on how AI-based educational tools can personalize learning experiences, identify students' learning needs, provide timely feedback and support educators in designing more effective learning activities. The analysis further considers the importance of ethical awareness, data privacy, human oversight and digital skills in ensuring responsible implementation of AI in educational environments. The expected findings indicate that integrating AI with intelligent learning approaches can enhance learner engagement, support individualized learning pathways and strengthen students' technological and problem-solving competencies. The study concludes that AI-driven digital transformation can contribute to future-ready education when technology is integrated with effective pedagogy and responsible practices. A balanced collaboration between educators, students and AI technologies can create more flexible, inclusive and adaptive learning environments while ensuring that human creativity, critical thinking and decision-making remain central to the educational process.

Keywords: Artificial Intelligence, Intelligent learning, Digital transformation, Higher education, Generative AI

Sparse-Aware LLM–GNN Collaboration for Detecting Coordinated LLM-Driven Botnets in Social Networks

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Social networks face persistent security threats from anomalous user behavior, coordinated botnets, influence campaigns, and Sybil attacks that exploit both content and network structure. Among these, the rapid emergence of large language model (LLM)-driven coordinated botnets poses a particularly severe challenge, as such bots can generate human-like interactions while deliberately shaping sparse or camouflaged topological patterns to evade detection. Existing hybrid LLM–GNN approaches still struggle with weak performance on sparsely linked or isolated malicious accounts and insufficient modeling of evolving structural relations under limited labeled data. To overcome these issues, this study presents a collaborative LLM–GNN framework specifically designed for structural detection of coordinated LLM-driven botnets. The LLM component first constructs unified textual sequences from user profiles, historical posts, and interaction metadata, then performs supervised fine-tuning to enhance semantic understanding of anomalous behavioral cues. Further, it generates high-quality structural evidence by identifying suspicious coordination patterns and produces human-interpretable rationales for why particular accounts exhibit malicious characteristics. Concurrently, the GNN component employs heterophily-aware gated message passing to selectively aggregate multi-hop neighborhood information while suppressing noisy or adversarial edges. Moreover, dynamic temporal interaction is explicitly modeled to capture the evolving nature of botnet topologies over successive time windows. Finally, an adaptive fusion module dynamically balances the semantic evidence produced by the LLM with the topological embeddings learned by the GNN through a learnable gating mechanism, enabling effective knowledge transfer even under severe label scarcity and concept drift. Extensive experiments on real-world social network benchmarks demonstrate that the proposed framework significantly outperforms state-of-the-art baselines in identifying coordinated LLM-driven botnets.

Keywords: Social network security, LLM, GNN, Botnet detection

A Hybrid Deep Learning Framework for Automated Histopathological Image Analysis

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Histopathological image analysis plays an important role in identifying disease related tissue patterns and supporting pathological assessment. However, manual examination of histopathological images is time consuming and may be affected by inter observer variability. Deep Learning has demonstrated considerable potential for automated histopathological image analysis, although effectively capturing complementary visual features from complex tissue structures remains challenging. This study presents a hybrid deep learning framework for automated analysis of histopathological images, evaluated in the context of osteosarcoma tissue classification. The proposed framework integrates YOLOv8 region detection with a hybrid DenseNet121 – Inceptionv3 classification model. YOLOv8 is employed to localize relevant tissue regions, while DenseNet121 and Inceptionv3 extract complementary deep feature representations through densely connected and multi-scale convolutional architectures, respectively. The classification task categorizes histopathological images into non-viable, viable, and non-tumor categories. Experiments were conducted on 1,048 histopathological images from an osteosarcoma dataset. The detection component achieved a mean average precision of 0.966 at an intersection over union threshold of 0.5, while the hybrid classification model achieved a test accuracy of 93.2%. The findings demonstrate the potential of combining object localization with complementary convolutional feature representations for automated histopathological image analysis and provide a foundation for developing computer aided approaches for osteosarcoma tissues characterization and broader histopathological-image-analysis. The approach separates the localisation of relevant tissue regions from their subsequent classification, allowing detection and classification performance to be assessed as distinct components. The reported results concern the evaluated osteosarcoma dataset; broader use requires additional independent validation across tissue sources and imaging conditions.

Keywords: Histopathological image analysis, Deep learning, Osteosarcoma, YOLOv8, Hybrid image classification

Technological Surveillance and Disciplinary Power: A Foucauldian Analysis of E. M. Forster's The Machine Stops (1909)

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E. M. Forster's The Machine Stops presents a society in which human life is completely organized through the Machine, raising the question of how technological systems regulate individual behavior, knowledge, communication, and independent thought. This study specifically examines how the Machine operates as a structure of surveillance and disciplinary power through the experiences of Vashti and Kuno. Previous scholarship on the novella has primarily examined technological dependence, dystopian modernity, dehumanization, and alienation, while comparatively limited attention has been given to the Machine as a system that produces disciplined subjects by controlling communication, knowledge, and acceptable patterns of behavior. To address this gap, the study employs close textual analysis through Michel Foucault's concepts of disciplinary power, surveillance, normalization, and the production of subjects. Particular attention is given to Vashti's dependence on the Machine and Kuno's resistance to its established norms to examine how technological control influences individual autonomy and intellectual engagement. The analysis further relates these conditions to specific competencies emphasized in the 21st century, particularly critical thinking, effective communication, adaptability, digital literacy, and responsible engagement with technology. The study finds that the Machine maintains discipline by normalizing technological dependence and discouraging behaviors that challenge its established system. Vashti's conformity demonstrates the internalization of these norms, whereas Kuno's resistance exposes the limitations imposed on independent thought, physical experience, and interpersonal communication. The study therefore establishes that Forster's Machine does not simply restrict physical freedom; it shapes the intellectual and social capacities of its users. By connecting Foucauldian disciplinary mechanisms with these specific competencies, the study highlights how The Machine Stops represents the consequences of technological dependence for human autonomy, critical engagement, and adaptive capacity.

Keywords: Michel Foucault, Disciplinary power, Surveillance, Digital literacy, The Machine Stops

Human–AI Entanglement: A Posthumanist Perspective on Intelligent Learning in Pedagogical Practice

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This paper proposes a posthumanist perspective on intelligent learning within pedagogical practice, positioned at the confluence of artificial intelligence, digital transformation, and STEAM education. Grounded in posthumanism, the study interrogates the anthropocentric premise that positions the human educator and learner as the sole loci of pedagogical agency, examining instead how intelligent systems, algorithms, and adaptive learning technologies participate as co-constitutive actors within contemporary classroom practice. The paper takes as its corpus intelligent tutoring systems (ITS) and adaptive learning systems in STEAM education, analysed through sustained qualitative and conceptual examination. Central to this inquiry is the notion of human–AI entanglement, which frames teaching and learning as emergent phenomena arising from the intra-active relations between human cognition, algorithmic processing, and material infrastructure, rather than as processes unilaterally directed by human intention alone. The paper articulates how nonhuman agency, distributed across intelligent tutoring systems, adaptive assessment tools, and algorithmic feedback loops, reconfigures conventional understandings of pedagogical authority and learner autonomy. Particular consideration is given to how such entanglement bears on digital transformation in STEAM classrooms, prompting a reassessment of curricular design, assessment practice, and the teacher's role amid increasingly autonomous learning technologies. The discussion further explores the implications of intelligent learning for equitable and inclusive pedagogical futures, resisting uncritical technological determinism while affirming the generative potential of human–AI collaboration. The paper concludes that a posthumanist framework offers a productive vocabulary for theorising intelligent learning as an entangled, more-than-human accomplishment, with implications for pedagogical theory, curriculum design, and future scholarship in STEAM education and intelligent learning.

Keywords: Artificial intelligence, Intelligent learning, Digital transformation, Posthumanism, STEAM education

HybridViT-BrainNet: A Convolutional-Transformer Fusion Perspective for Brain Tumor Detection and Classification in MRI

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Accurate and early detection of brain tumors from magnetic resonance imaging (MRI) remains a critical challenge in computer-aided diagnosis, where subtle variations in tumor shape, texture, and location demand models capable of capturing both fine-grained local detail and holistic contextual information. Convolutional Neural Networks (CNNs) excel at extracting local textural features but are inherently limited in modeling long-range spatial dependencies across tumor boundaries and surrounding brain structures. Vision Transformers (ViTs), while effective at capturing global context through self-attention, often underperform on limited medical datasets due to their weaker local inductive bias. This work explores a hybrid Vision Transformer framework tailored for brain tumor detection and classification, in which convolutional layers extract localized structural and textural cues while transformer blocks model global inter-regional dependencies across MRI slices. The proposed perspective investigates how such local-global feature fusion can enhance discrimination among tumor subtypes, including glioma, meningioma, and pituitary tumors, while improving robustness to variations in tumor size and location. Experiments conducted on the BraTS (Brain Tumor Segmentation) benchmark dataset demonstrate that the hybrid architecture achieves improved classification accuracy and more reliable tumor localization compared to standalone CNN or transformer baselines, evaluated using accuracy, precision, recall, and F1-score metrics. The results suggest that combining convolutional inductive bias with transformer-based global attention offers a promising direction for building more reliable and generalizable brain tumor diagnostic systems. This study represents a focused component of a broader ongoing investigation into hybrid transformer architectures for neuro-oncological imaging, with several design and optimization aspects reserved for continued research. Future work will explore extended validation across multi-institutional datasets and additional tumor grading tasks.

Keywords: Brain tumour classification, Hybrid vision transformers, BraTS dataset, MRI image analysis, Convolutional-transformer fusion

Rethinking Formative Assessment: An Insight from Teachers About Utilization of Kahoot as an Online Formative Assessment Tool in Online Learning

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This study examined teachers' experiences of using Kahoot as a formative assessment tool in online learning. It focused on how online quizzes could support assessment, participation, and feedback in B.Ed. teaching. A classroom action research approach was adopted to investigate an identified problem in formative assessment and inform teaching practice through an intervention. During the intervention, B.Ed. students completed formative assessment quizzes using Kahoot. Teachers who observed and experienced its use in online classrooms were selected as participants. Semi-structured interviews explored their views of the tool and its role in the learning process. The study reports that procedures addressing credibility, transferability, dependability, and confirmability were used to support the trustworthiness of the qualitative inquiry. Interview data were examined through thematic analysis. Teachers reported that students found the activities engaging and visually appealing, and that the quizzes helped students apply principles to real-world issues. They also valued the integration of Kahoot into online sessions as a means of encouraging active participation and experiential learning. Immediate feedback and rapid assessment were identified as benefits for both teachers and students. Participants described the platform's visual and auditory features as contributing to an enjoyable learning experience. These findings reflect teachers' perceptions of the intervention rather than independently measured gains in student achievement. The study concludes that Kahoot can support formative assessment in online settings by combining participation, feedback, and opportunities to apply learning. Its contribution lies in documenting teachers' experiences of a classroom intervention and identifying perceived benefits that can inform the design of online assessment activities.

Keywords: Kahoot, Formative assessment, Online learning

AI-Enabled Financial Decision-Making in SMEs: Opportunities, Risks and a Framework for Future-Ready Businesses

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Artificial Intelligence (AI) is increasingly transforming how businesses process information, evaluate risks, and make financial decisions. For small and medium-sized enterprises (SMEs), AI-enabled financial tools may support forecasting, budgeting, cash-flow management, credit assessment, investment analysis, and fraud detection, while also creating challenges related to data quality, transparency, privacy, cybersecurity, model risk and excessive reliance on automated recommendations. This conceptual study examines the potential role of AI in enhancing financial decision-making within SMEs and proposes a framework linking AI capabilities, responsible AI adoption, financial decision quality and organizational outcomes. The framework is developed through a conceptual synthesis of the key financial decision areas, opportunities, risks and governance requirements identified in the study. It proposes that AI effectiveness depends not only on technological capabilities but also on reliable and secure data, explainability of AI-generated outputs, appropriate governance mechanisms and continued human oversight. The study further proposes a responsible AI process involving the definition of financial objectives, data preparation, AI-based analysis, validation, managerial decision-making, continuous monitoring and learning. The study concludes that AI should be treated as a decision-support capability rather than a replacement for managerial and professional financial judgment. The proposed framework provides practical guidance for SME managers seeking to integrate AI responsibly and offers a foundation for future empirical research on the relationship between AI adoption and financial decision quality. As a conceptual contribution, the framework sets out relationships for subsequent investigation; it does not establish empirically measured improvements in SME financial performance or decision outcomes under varying data and governance conditions.

Keywords: Artificial intelligence, Financial decision-making, SMEs, Responsible AI, Digital transformation

Assessment of Physiotherapists' Confidence and Trust in AI Predictive Models for Clinical Decision Making

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AI predictive models are increasingly used in healthcare to support clinical decision-making. However, physiotherapists' confidence and trust in these tools remain understudied, particularly in low-income countries like Pakistan. This study provides the first empirical assessment of Pakistani physiotherapists' perspectives on AI predictive models. The objective of the study was to evaluate physiotherapists' confidence and trust in AI-based predictive models for clinical decision-making, and to examine the influence of demographic and experience-related factors on these attitudes. A cross-sectional study recruited 134 physiotherapists across Pakistan via convenience sampling. Data was collected using the Trust in Automation Scale (TIAS) and Technology Acceptance Model (TAM) on a 7-point Likert scale. Spearman's Rho assessed inter-constructs correlation. Participants showed favourable attitudes with mean scores of 5.92 (Perceived Usefulness), 5.97 (Perceived Ease of Use), and 5.35 (Trust) on a 7-point scale. All scales demonstrated strong reliability (Cronbach's $\alpha \geq .892$). PU and PEU were strongly correlated ($r_s = .785$, $p < .001$), both showing moderate positive associations with Trust. Male physiotherapists, those aged 35–44, and those with formal AI training or prior clinical AI experience scored significantly higher across all dimensions ($p \leq .004$). Pakistani physiotherapists generally hold positive views of AI predictive models, with formal training and clinical experience as the strongest predictors of acceptance. Integrating structured AI education into physiotherapy curricula and addressing gender-related disparities in AI adoption are strongly recommended.

Keywords: Artificial Intelligence, Physiotherapy, Clinical Decision Making, Technology Acceptance Model, Trust, Pakistan, AI Predictive Models, Rehabilitation

Explainable Artificial Intelligence for Intelligent Learning: Enhancing Transparency and Trust in AI-Based Education

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Artificial Intelligence (AI) is rapidly transforming the educational landscape by supporting personalized learning, student performance prediction, automated assessment, and intelligent educational decision-making. However, the increasing use of AI-based systems in education has raised concerns regarding the transparency and interpretability of AI-generated predictions and recommendations. This study explores the role of Explainable Artificial Intelligence (XAI) in intelligent learning environments to improve transparency, trust, and understanding among educators and learners. A comprehensive review of existing AI-based intelligent learning approaches is conducted, with particular emphasis on explainability techniques that can interpret the decisions of complex machine learning and deep learning models. Model-agnostic techniques, including SHapley Additive exPlanations (SHAP) and Local Interpretable Model-Agnostic Explanations (LIME), are examined for their potential to provide meaningful explanations of AI-based educational predictions. The reviewed approaches demonstrate that explainable AI can help identify the factors influencing student performance, support educators in understanding model predictions, and improve confidence in AI-assisted educational decision-making. The study further identifies important challenges, including data privacy, fairness, model complexity, explanation quality, and the varying technical understanding of educational users. The findings indicate that integrating explainability into intelligent learning systems can promote more transparent, trustworthy, and learner-centered AI applications. The study provides a foundation for developing responsible and explainable intelligent learning environments that can support personalized and adaptive education and contribute to future-ready educational societies.

Keywords: Artificial Intelligence, Explainable AI, Intelligent Learning, Personalized Learning, Educational Technology

Effect of Improving Learning Outcomes Through Intelligent Tutoring Systems in Behavior of Students

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This study examines the role of intelligent tutoring systems (ITS) in improving learning outcomes and supporting positive changes in student behaviour. It considers how technology-supported pedagogy can create interactive learning environments while encouraging students to apply and develop their own skills. The study treats the intelligent tutoring system as the independent variable and student behaviour as the dependent variable. A quantitative research approach is used, with questionnaire responses analysed through the Statistical Package for the Social Sciences (SPSS). The questionnaire contains ten items measured on a five-point Likert scale and includes demographic information on age and gender. The investigation focuses on the relationship between ITS-supported learning, instructional interaction, and students' responses to the learning environment. The reported findings describe an interactive learning environment associated with the use of intelligent tutoring systems. They also emphasise that students remain responsible for applying their skills and engaging actively with the learning process. The study identifies the student model, pedagogy model, and expert model as central components of ITS-supported learning. Together, these components connect information about learners, approaches to instruction, and subject knowledge within the tutoring environment. Students acquire knowledge through interaction with the system and may use predictions that are subsequently challenged or revised. This process highlights the importance of developing more suitable learning models and supporting students as they reconsider their understanding. The study concludes that intelligent tutoring systems can support interactive pedagogy, while their educational value depends on the relationship between system design and active student participation. The findings provide a basis for examining how tutoring models can better respond to learners' needs and support positive behavioural development.

Keywords: Intelligent tutoring systems, Learning outcomes, Pedagogy, Student behavior, Interactive learning

AI-based Mental Health Support for Informal Help-Seekers: Opportunities, Ethical Challenges, and Future Prospects for Psychological Care

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Many people across the globe experience psychological distress, yet a large number never access conventional services because of stigma, cost, geographic distance, and a shortage of trained professionals. Such individuals are increasingly turning to AI-based tools, including purpose-built therapeutic chatbots and general-purpose conversational systems, for emotional support, guidance, and information. This paper examines AI-based mental health support for informal help-seekers, that is, individuals who look for support outside formal psychological services, focusing on its opportunities, ethical challenges, and implications for the future of psychological care. Using a narrative review of peer-reviewed literature and professional guidance, the paper synthesizes evidence on the accessibility, acceptability, and reported benefits of these tools. However, ethical concerns remain, which include privacy and security of sensitive data, inadequate detection and management of crises and suicide risk, algorithmic bias, limited cultural and linguistic sensitivity, risk of over-reliance, unclear accountability, and weak regulatory oversight. These issues are particularly pressing in low-resource contexts such as Pakistan, where the treatment gap is wide and digital tools are often adopted without adequate safety measures. This paper contends that AI should complement rather than replace human clinicians and proposes a stepped-care perspective in which AI supports low-intensity needs and facilitates referral to qualified professionals, supported by structured systems. By bridging psychology and technology, the paper contributes to interdisciplinary dialogue on responsible innovation and offers practical recommendations for practitioners, developers, and policymakers seeking to expand access to mental health care ethically. The proposed approach emphasizes accessible support alongside safeguards, professional oversight, and clear pathways to appropriate care.

Keywords: Informal help-seeking, AI-based mental health support, Mental health chatbots, Ethical challenges, Stepped care

Triangular Intuitionistic Fuzzy Hypergraph (TIFHG)

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The mathematical description of complex systems frequently involves uncertainty, hesitation, and relationships among several interacting objects. Classical graph theory is primarily designed for pairwise relations, whereas hypergraph theory extends this structure by allowing a single hyperedge to connect an arbitrary number of vertices. Nevertheless, crisp hypergraphs are not sufficiently expressive when the participation of vertices, the strength of hyperedges, or the associated relational information is imprecise. Fuzzy hypergraphs address graded participation, and intuitionistic fuzzy hypergraphs provide a richer description by simultaneously assigning membership and non-membership information together with the corresponding hesitation degree. Motivated by these developments, this work considers a Triangular Intuitionistic Fuzzy Hypergraph (TIFHG) as a higher-order uncertainty model that combines the structural flexibility of hypergraphs with triangular intuitionistic fuzzy information. The triangular representation allows an uncertain quantity to be described through lower, modal, and upper assessments, while the intuitionistic component preserves degrees of membership, non-membership, and hesitation. Consequently, a TIFHG can represent multi-vertex interactions whose intensities cannot be adequately expressed by a single crisp or fuzzy value. The framework provides a basis for studying support, order, size, incidence, adjacency, vertex degree, hyperedge degree, strength, level cuts, duality, complement, union, intersection, isomorphism, domination, transversals, matching, and connectivity under triangular intuitionistic uncertainty. It also permits the investigation of reduction properties linking TIFHGs with intuitionistic fuzzy hypergraphs, fuzzy hypergraphs, and classical hypergraphs under suitable restrictions. The resulting structure therefore offers a mathematically consistent direction for extending fuzzy hypergraph theory to situations in which multi-way relations are accompanied by graded uncertainty and hesitation. The proposed viewpoint is expected to support the development of new definitions, structural results, inequalities, and theorem-based analysis for uncertain higher-order relational systems.

Keywords: Triangular intuitionistic fuzzy hypergraphs, Intuitionistic fuzzy sets, Hypergraphs, Higher-order relations, Uncertainty

A Novel Theoretical Framework for Linguistic Fermatean Fuzzy Sets with New Operations and Aggregation Operators

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Conventional fuzzy set theory provides a mathematical framework for representing ambiguity, but richer approaches are needed when decision information is expressed linguistically and involves multiple forms of uncertainty. This study develops a theoretical framework based on Linguistic Fermatean Fuzzy Sets (LFFSs) to address these representational and aggregation needs. The proposed model combines linguistic variables with the Fermatean fuzzy structure, allowing membership and non-membership information to be expressed through linguistic terms while satisfying the Fermatean constraint. The development proceeds through the formulation of basic operations, comparison functions, and aggregation operators. Fundamental operations include union, intersection, complement, algebraic sum, algebraic product, and related operational laws. Score and accuracy functions are introduced to facilitate the comparison and ranking of Linguistic Fermatean fuzzy numbers. Arithmetic, geometric, weighted arithmetic, and weighted geometric aggregation operators are developed to combine multiple items of Linguistic Fermatean fuzzy information. These operators provide alternative ways to consolidate assessments, including situations in which different inputs carry different weights. The characteristics of the proposed operators are investigated and illustrated through numerical examples. A multi-criteria decision-making framework demonstrates how the proposed representation and aggregation procedures can be applied to problems involving imprecise, uncertain, and linguistic information. The contribution therefore connects the representation of individual assessments with their combination and subsequent comparison in a decision-making process. The proposed framework offers a systematic mechanism for handling linguistic uncertainty within the Fermatean fuzzy setting. Its demonstrated applicability is based on the theoretical development and numerical illustrations described in the study, providing a basis for further investigation of decision problems requiring flexible representations of uncertain information.

Keywords: Linguistic Fermatean fuzzy sets, Aggregation operators, Linguistic uncertainty, Score functions, Multi-criteria decision-making

An Elliptical Bipolar Spherical Fuzzy Set-Based MCDM Approach for Artificial Intelligence Applications

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Fuzzy sets provide a mathematical framework for representing information whose boundaries are not crisp. Subsequent developments, including intuitionistic, bipolar, spherical, and other generalized fuzzy models, have increased the ability of fuzzy mathematics to represent positive degree, negative degree, hesitation degree, and non-membership simultaneously. In this paper, an Elliptical Bipolar Spherical Fuzzy Set (EBSFS) is proposed as a unified framework that combines bipolar information with spherical membership, abstinence, non-membership structure and an elliptical normalization mechanism. The proposed EBSFS represents positive and negative information through six components, namely positive membership, positive abstinence, positive non-membership, negative membership, negative abstinence, and negative non-membership. The three dimensions on each bipolar side are normalized by elliptical parameters a, b, and c, and the normalized degrees μ/a, η/b, and ν/c are used throughout the mathematical development. Basic operational laws, including multiplication, addition, scalar multiplication, and scalar addition, are defined using standard spherical fuzzy t-conorm/t-norm patterns on the normalized coordinates. Averaging and weighted averaging operators are then developed. Numerical examples are provided to verify the operations and the elliptical constraints. Several basic properties, including closure, idempotency of averaging, boundedness, and monotonicity, are stated and proved. Finally, a conceptual artificial-intelligence framework is presented in which EBSFS information can be incorporated into graph-based or neural-network-based learning systems. The proposed framework is intended as a mathematical foundation for future applications involving uncertain, conflicting, and relational information. The proposed AI integration remains conceptual, and its predictive performance must be established through future empirical evaluation. Such evaluation would examine the framework in concrete learning and decision-making tasks.

Keywords: Elliptical bipolar spherical fuzzy sets, Aggregation operators, Multi-criteria decision-making, Artificial intelligence, Uncertainty modelling

Thermal and Hydrodynamic Behavior of Al_2O_3–Cu/Water Hybrid Nanofluid across a Stretching Rotating Disk with MHD and Darcy Resistance

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This study examines heat transfer and flow characteristics of an Al_2O_3–Cu/water hybrid nanofluid over a stretching rotating disk under the combined effects of magnetohydrodynamics, thermal radiation, and Darcy porous-medium resistance. The objective is to investigate how these effects influence the velocity and temperature fields and the associated surface transport quantities. The mathematical formulation describes steady, incompressible, axisymmetric flow. Suitable similarity transformations reduce the governing equations to a system of nonlinear ordinary differential equations, which is solved numerically using the MATLAB bvp4c boundary-value solver. The analysis considers the effects of the stretching parameter, magnetic parameter, thermal radiation parameter, Darcy porosity parameter, and nanoparticle concentration. Radial, tangential, and axial velocity components are examined alongside the temperature distribution and temperature gradient. The corresponding skin-friction coefficient and Nusselt number are evaluated to characterize surface friction and heat transfer. The reported findings show that increasing the magnetic and porous-medium parameters suppresses the velocity components. Thermal radiation increases the temperature distribution while reducing the heat-transfer rate. Increasing nanoparticle concentration generally improves the heat-transfer capability of the hybrid nanofluid. Together, these observations describe the influence of the investigated parameters on momentum and thermal transport over the rotating surface. The study combines similarity-based mathematical modelling with numerical boundary-value analysis to examine a coupled flow and heat-transfer problem. Its findings indicate the potential of Al_2O_3–Cu/water hybrid nanofluids for thermal-management applications involving rotating surfaces. The conclusions concern parameter-dependent trends in the numerical model and highlight the coupled influence of magnetic, porous-medium, radiative, and nanoparticle effects. These trends provide a basis for further assessment of hybrid nanofluid performance in rotating-disk configurations.

Keywords: Al_2O_3–Cu/water hybrid nanofluid, Magnetohydrodynamics, Darcy resistance, Thermal radiation, bvp4c

An Intuitionistic Fuzzy Neural Network Based on Sugeno-Weber and its Practical Application for Decision-Making

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Circular intuitionistic fuzzy sets provide a framework for analysing uncertain information through membership, non-membership, radius, and hesitation-related characteristics. This study develops an approach that integrates circular intuitionistic fuzzy information with Sugeno-Weber aggregation and a neural-based ranking scheme for decision-making. The mathematical development first describes the four characteristics of circular intuitionistic fuzzy sets and then extends their aggregation through the Sugeno-Weber model. Circular intuitionistic fuzzy Sugeno-Weber weighted averaging and weighted geometric operators are introduced to combine assessments within a multi-attribute group decision-making setting. Score and accuracy functions are also extended to support the comparison and ranking of circular intuitionistic fuzzy information. A neural-based scheme incorporating cubic correlation coefficients is introduced with the aim of improving the computational efficiency of the ranking process. The approach is illustrated through an application involving an MRI machine and a detailed numerical example. This example demonstrates how the proposed representation, aggregation, and ranking procedures can be brought together in a practical decision-making context. The contribution lies in linking circular intuitionistic fuzzy modelling with Sugeno-Weber operators and a neural-based computational component. The resulting framework offers a flexible approach for combining uncertain assessments and ordering alternatives in multi-attribute group decision-making problems. The numerical illustration supports the applicability of the proposed model within the reported example; broader claims about comparative accuracy or computational efficiency require explicit benchmark results. Further evaluation can examine its performance across different decision settings and assessment conditions.

Keywords: Circular intuitionistic fuzzy sets, Sugeno-Weber aggregation, Neural networks, Multi-attribute group decision-making, MRI

Ethical Leadership and Employee Engagement in Sustainability: The Mediating Role of Organizational Commitment and the Moderating Role of Sustainability Climate

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This study examines ethical leadership and employee engagement in sustainability within organisations in Pakistan. It considers the relationships among ethical leadership, organisational commitment to sustainability, perceptions of the sustainability climate, employee sustainability initiatives, and engagement in sustainability efforts. The purpose is to understand how leadership relates to organisational commitment and how that commitment connects with employees' participation in sustainability initiatives. The study draws on supply-value fit theory and the theory of planned behaviour to frame these relationships. Organisational commitment to sustainability is examined as a mediating factor, while perceptions of the organisational sustainability climate are considered as a moderating factor. Data were collected from employees working in the textile, insurance, banking, and tourism sectors. This cross-sector context provides the setting for examining leadership, organisational conditions, and employee participation in sustainability within Pakistan. The study connects these organisational factors with employees' sustainability initiatives and engagement, bringing leadership and employee participation into a shared explanatory framework. Its contribution lies in examining these relationships together within a specific national and cultural context. The findings offer insights for practitioners and policymakers seeking to strengthen sustainability efforts through leadership practices and supportive organisational conditions. The study concludes that attention to ethical leadership, commitment, and sustainability climate can inform efforts to encourage employee involvement in organisational sustainability. These implications are relevant to organisations in Pakistan and may inform further research in similar cultural settings, where the relationships between leadership and employee sustainability engagement warrant contextual examination.

Keywords: Ethical leadership, Organizational commitment, Sustainability climate, Employee engagement, Sustainability initiatives

Human–AI Collaboration in AI-Generated Micro-Dramas: A Posthumanist Study of Digital Storytelling

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This proposed study examines human–AI collaboration in AI-generated micro-dramas on Instagram, focusing on how narrative structure, character development, and visual storytelling are constructed in short episodic stories. It addresses the limited literary attention given to micro-dramas as an emerging form of digital literature and explores how human creative input interacts with AI-generated narrative content. The research adopts a qualitative design informed by posthumanism, Actor–Network Theory, and narratology. Posthumanism provides a perspective on creativity beyond exclusively human authorship, while Actor–Network Theory supports examination of relationships among human creators, AI tools, the platform, and audiences. Narratology guides analysis of plot organisation, characterisation, and episodic sequencing. The proposed corpus comprises one complete story series from the Instagram account @thedaydreamtales, consisting of approximately 20–30 consecutive reels or the entire selected series. Dialogue and narrative sequences will be transcribed, and textual and visual elements will be examined together. Analysis will address story progression, character development, conflicts, themes, visual language, narrative sequencing, and cliffhanger endings. These elements will be interpreted through the three theoretical perspectives to explore how collaborative storytelling is represented in the selected micro-dramas. The study is expected to clarify how human–AI collaboration shapes episodic narratives and to contribute a literary account of AI-assisted visual storytelling. It also aims to examine the implications of this collaboration for digital authorship and changing understandings of creativity. As a proposed investigation, it presents anticipated contributions rather than completed empirical findings. Its intended contribution is an integrated framework for studying AI-generated micro-dramas within digital literature, literary criticism, and the digital humanities.

Keywords: Human–AI collaboration, Micro-dramas, Posthumanism, Digital storytelling, Narratology

Characterization of Activation Energy and Hartmann Number on Tangent Hyperbolic Fluid Flow through an Inclined Sheet

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This study investigates the flow characteristics of a tangent hyperbolic fluid over an inclined stretching sheet, with attention to the effects of magnetic forcing and associated transport parameters. The fluid exhibits non-Newtonian behaviour, and the mathematical model incorporates magnetohydrodynamics, mixed convection, and temperature-dependent thermal conductivity. The objective is to examine how variations in the controlling parameters influence velocity, temperature, and concentration distributions within the modelled flow. Governing partial differential equations are formulated and transformed into ordinary differential equations using similarity transformations. The resulting boundary-value problem is solved numerically with the bvp4c solver in MATLAB. Graphs and tables are used to examine parameter-dependent changes in the computed profiles and to interpret the associated transport behaviour. The reported results show that increasing the Hartmann number reduces the velocity profile. A similar decrease in velocity is observed as the power-law index increases. Increasing the Prandtl number reduces the temperature distribution. The investigation also examines skin friction and the Nusselt number, linking their increasing or decreasing trends to the mechanisms represented in the mathematical model. These quantities complement the profile analysis by describing surface resistance and heat-transfer behaviour. The study brings together magnetic effects, non-Newtonian flow characteristics, mixed convection, and variable thermal conductivity within a numerical framework for transport over a stretching surface. Its findings describe the response of the model to changes in the selected parameters rather than experimental measurements. The study concludes that the Hartmann number, power-law index, and Prandtl number are important controls on the reported velocity and temperature distributions. The numerical approach provides a basis for further examination of coupled flow and thermal transport in tangent hyperbolic fluids.

Keywords: Inclined magnetic field, Stretching sheet, Tangent hyperbolic fluid, Hartmann number, bvp4c

Use of Artificial Intelligence in the Legal System of Pakistan Compared with United States Legislation on AI

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Artificial intelligence (AI) is creating questions about regulation, ethics, and institutional readiness within legal systems. This study presents a comparative analysis of AI integration and governance in Pakistan and the United States, focusing on implications for judicial and legal practice. Its purpose is to examine the regulatory issues identified in the two jurisdictions and consider lessons relevant to the development of Pakistan's approach to AI. The research uses a qualitative, doctrinal methodology based exclusively on secondary sources, including scholarly articles, government reports, legislative texts, and policy documents. The analysis considers legislation, executive measures, and regulatory guidance as components of AI governance and examines their relevance to legal institutions. It focuses on how the reviewed materials address technological adoption, ethical responsibilities, and institutional capacity. The study identifies gaps in the Pakistani legal framework discussed in its source materials and examines the United States' evolving governance arrangements as a point of comparison. The reported findings emphasise the need for clearer legislative provisions, ethical guidance, and judicial capacity building in Pakistan. These priorities connect the regulation of AI with the practical ability of legal institutions to understand and oversee its use. The comparison provides a basis for discussing how regulatory lessons may inform local policy while recognising that the two jurisdictions operate within different legal and institutional contexts. The study concludes that the integration of AI into Pakistan's legal system requires coordinated attention to legislation, professional preparation, and ethical governance. Its contribution is a doctrinal perspective on the relationship between technological change and legal readiness, intended to inform further discussion of responsible AI adoption within the justice system.

Keywords: Artificial intelligence, Legal system, Pakistan, United States, AI legislation

Intelligent Learning in the Age of Artificial Intelligence: Opportunities, Risks and Ethical Challenges

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Artificial intelligence (AI) is changing education through intelligent learning systems that personalise instruction, provide immediate feedback, and assist teachers with teaching and assessment. This study examines the opportunities, risks, and ethical challenges associated with these systems and considers their role in preparing education for future technological change. A qualitative, literature-based approach is used to examine academic discussions and policy debates on AI in education. The analysis focuses on personalised learning, accessibility, teacher–learner relationships, academic integrity, privacy, algorithmic bias, digital inequality, and increasing dependence on AI tools. The review identifies opportunities for differentiated instruction, wider access to educational resources, support with repetitive teaching tasks, and more flexible, learner-centred educational experiences. It also identifies concerns about learner data security, transparency in automated decisions, unequal access to digital technologies, biased system outputs, reduced human interaction, and students' reliance on AI-generated content. These opportunities and concerns indicate that the educational value of intelligent systems depends on how they are introduced and supervised. The analysis suggests that technological adoption alone cannot produce meaningful educational transformation. Ethical safeguards, digital literacy, responsible-use policies, teacher preparation, and continuing human oversight are necessary elements of implementation. Attention to these conditions can help institutions assess whether intelligent learning tools support educational goals while protecting learners and maintaining academic integrity. The study concludes that AI should supplement human-centred education and preserve the role of teachers in guiding learning and assessment. Combining technological innovation with human responsibility offers a basis for educational systems that encourage critical engagement, inclusion, and ethical participation in increasingly AI-enabled societies. This approach places learners' needs and educational relationships at the centre of decisions about intelligent learning.

Keywords: Artificial intelligence, Intelligent learning, Digital transformation, Educational technology, Ethics

Trust-Aware Federated Learning for Privacy-Preserving Intrusion Detection in Intelligent IoT Networks

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The rapid expansion of Internet of Things (IoT) technologies has created intelligent and interconnected environments that support diverse applications, while simultaneously increasing exposure to cyber threats and privacy risks. Conventional centralized intrusion detection systems require collecting network data at a central server, which can raise privacy concerns, create communication bottlenecks, and create a single point of failure. Federated Learning (FL) provides a promising alternative by allowing multiple IoT devices to collaboratively train machine learning models without directly sharing their local data. However, conventional federated learning approaches generally assume that participating clients are reliable, making them vulnerable to malicious or unreliable participants that may submit manipulated model updates. This study proposes a trust-aware federated learning approach for privacy-preserving intrusion detection in intelligent IoT networks. The proposed framework evaluates the reliability of participating clients using model-based and behavioral trust indicators before incorporating their updates into the global learning process. Client contributions are assessed according to their consistency with the global model and their historical participation, enabling potentially unreliable updates to be identified and excluded from aggregation. The framework is designed to improve the robustness of federated intrusion detection while maintaining data privacy because raw IoT traffic remains locally stored. Its effectiveness can be evaluated using established intrusion-detection datasets under both independent and heterogeneous client data distributions. Performance will be assessed using accuracy, precision, recall, F1-score, false-positive rate, convergence behavior, and communication overhead. The proposed approach shows how integrating artificial intelligence, federated learning, trust management, and IoT security can support reliable, privacy-preserving intelligent systems for future-ready digital environments.

Keywords: Federated learning, Trust management, IoT security, Intrusion detection, Privacy preservation

Integrated Sensing and Communication as an Enabling Technology for Smart and Future-Ready Societies

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Integrated sensing and communication (ISAC) is emerging rapidly as a key enabling technology for sixth generation (6G) wireless systems, where communication networks can exchange data and sense the physical environment simultaneously by exploiting common spectrum, waveforms, and hardware resources. Such convergence could be of great benefit to future-ready societies that tightly integrate connectivity, situational awareness, automation and intelligent decision-making. The enabling technology function of ISAC is investigated in this study for a number of representative application domains, including intelligent transportation, autonomous vehicles, smart cities, industrial automation, unmanned aerial vehicles, healthcare monitoring, and environmental sensing. This study proposes an organized literature-based methodology to synthesize the recent advances on ISAC architectures, enabling techniques, and application requirements. The analysis focuses on the potential of joint sensing and communication for enabling low latency context-aware services, reducing infrastructure duplication, improving localization and perception capabilities, and improving spectral and energy efficiency. The major technical issues are critically discussed, including waveform and beamforming design, sensing-communication trade-offs, interference management, resource allocation, hardware limitations, privacy, and the use of artificial intelligence for adaptive system operation. A conceptual application-oriented framework is proposed based on the synthesis, linking fundamental ISAC capabilities to the functional needs of forthcoming smart environments. The study's contribution is to highlight the technological and societal importance of ISAC beyond traditional wireless connectivity and to determine the most important research areas needed for practical implementation. The results indicate that ISAC could play an important role in future digital infrastructure, especially in scenarios that require reliable communication and real-time awareness of the environment on the same wireless platform. Special emphasis is given on the scalable, secure, and sustainable deployment routes for dense heterogeneous 6G environments.

Keywords: Integrated sensing and communication, 6G networks, Smart societies, Intelligent wireless systems, Joint sensing and communication

Next Generation 5G Routing Enabled by Graph Neural Networks Integrated with Mobile LLAMA

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Combined with network slicing, multi-access edge computing (MEC), software-defined networking (SDN), network function virtualization (NFV) and cloud-native architectures, fifth-generation networks (5G) form highly dynamic and distributed communication environments. Despite this, the existing inter-domain routing is still based on traditional policy-driven approaches to routing which are not adaptable, context-aware, and explainable when it comes to detecting complex routing anomalies. While using a large language model (LLM) like LLaMA for interpreting textual and sequential routing data can be effective, it fails to explicitly model the structural dependencies in Autonomous System (AS) topologies. On the other hand, Graph Neural Networks (GNNs) can capture the graph-structured relationships and learn the graph structure well but are not so good at producing human-readable explanations. This study introduces a hybrid GNN–Mobile-LLaMA framework, which combines graph-based structural reasoning with language-based contextual understanding, for intelligent BGP routing anomaly detection and analysis. An attributed AS-level routing graph was built using BGP routing updates, AS relationships and network performance data. A cross-attention fusion mechanism with enhanced low-rank adaptation (LoRA) was coupled with the structural representation learned by the Graph Attention Network (GAT), supporting efficient fusion of multimodal features and inference. The proposed framework was experimentally evaluated and was found to be superior in terms of accurate and interpretable explanations and consistently superior in detecting routing anomalies over graph-only, language-only, and traditional rule-based approaches. The framework also showed high robustness, calibration stability, and computational efficiency, and stable performance under different experimental conditions. The study proposes a novel multimodal routing-intelligence framework that leverages the graph representation learning and lightweight language models to provide explainable, scalable, and reliable routing-intelligence analysis solutions for intelligent BGP routing in secure, resilient, and autonomous communication networks for next-generation 5G and future 6G networks.

Keywords: Graph neural networks, Mobile LLaMA, BGP anomaly detection, 5G networks, Explainable AI

Trust-Aware Brain Tumor Analysis Using Evidential Deep Learning for Calibrated Uncertainty Estimation

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Deep learning models have been rapidly developed and have led to high-performance brain tumour analysis using Magnetic Resonance Imaging (MRI). But prediction precision is not enough to ensure reliable clinical decision-making, especially in the presence of uncertain and new cases. Recent work has already achieved classification rates of up to 96-99.8% and segmentation Dice scores greater than 0.9 and uncertainty estimation is still relatively under-researched. The aim of this study is to propose a trust-aware deep-learning framework for accurate brain tumor analysis beyond the traditional accuracy metric by integrating calibrated uncertainty estimation into the deep-learning pipeline. The proposed solution uses a shared Attention U-Net based encoder and a simple multi-scale feature-fusion module and prediction heads specific to the analysis of the tumour. Evidential Deep Learning (EDL) is incorporated as the main uncertainty-estimation method, and Monte Carlo Dropout is used as a comparison for ablation. The proposed framework will be tested with publicly available MRI data, such as Figshare, Kaggle brain tumour datasets, BraTS 2020/2021, and a completely external dataset for cross-domain testing. Model assessment will rely on the following measures of model reliability: Expected Calibration Error (ECE), risk–coverage analysis, predictive performance and predictive referral based on confidence. Furthermore, the study will explore the possibility of using uncertainty estimation to distinguish reliable predictions from those that still need to be brought to the attention of experts. To provide robust evaluation, five-fold cross-validation, multiple random seed runs, and paired statistical testing will be used, along with bootstrap confidence intervals. The study seeks to create clinical brain tumor analysis model predictions with measurable confidence to improve the safety and reliability of clinical AI systems.

Keywords: Brain tumour analysis, Evidential deep learning, Uncertainty quantification, Trustworthy AI, MRI

Trustworthy Healthcare Using Colored Petri Nets for AI-Driven Medical Imaging

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This study proposes an approach to trustworthy medical imaging that combines convolutional neural networks (CNNs), explainable artificial intelligence (XAI), and Colored Petri Nets (CPNs). It focuses on kidney tumour detection, where predictive outputs must be interpreted and examined within a structured decision process. The objective is to connect automated image analysis with explanations and formal modelling of the steps leading to a decision. A CNN is used within the proposed pipeline to analyse medical images and identify patterns associated with kidney tumours. XAI techniques highlight the image regions that contribute to individual predictions, providing information for interpreting the model's outputs. Predictions and explanations are then represented within a Colored Petri Net through defined states, transitions, and logical conditions. This representation supports systematic examination of the consistency of the decision workflow before it reaches a designated trusted decision state. The contribution lies in bringing predictive modelling, interpretability, and a formal representation of decision processes into one conceptual pipeline. Each component addresses a different aspect of the proposed approach: image-based prediction, interpretation of model behaviour, and structured examination of the workflow. The study presents this integration as a basis for improving the assessment of trustworthiness in CNN-based kidney tumour analysis. It does not report completed quantitative validation of diagnostic performance or clinical reliability. The approach therefore provides a model for further evaluation of how predictions and explanations can be assessed together within a formally specified process. The study concludes that integrating CNNs, XAI, and CPNs offers a structured direction for investigating trustworthy AI-assisted medical imaging, with empirical validation needed before claims about clinical effectiveness can be established.

Keywords: Trustworthy AI, Colored Petri Nets, Medical imaging, Convolutional neural networks, Explainable AI

Explainable Multimodal GNN Framework for Lung and Colon Cancer Diagnosis and Prognosis

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Lung and colon cancers remain major causes of cancer-related morbidity and mortality, while histopathological diagnosis is still dependent on expert visual assessment that can be time-consuming, labor-intensive, and subject to inter-observer variability. This study proposes an explainable multimodal artificial intelligence framework that integrates transformer-based histopathological analysis, graph neural network (GNN) modeling of the tumor microenvironment, and patient clinical information to support cancer diagnosis and prognostic risk stratification. Publicly available histopathology datasets, including LC25000 and CRC-100K, will be used for model development, with LungHist700 considered for external validation to assess generalizability. After image preprocessing, stain normalization, quality control, and cell or nuclei segmentation, Vision Transformer or Swin Transformer architectures will extract global histomorphological features from tissue images. In parallel, spatial cellular graphs will be constructed in which cells or nuclei are represented as nodes and their spatial relationships as edges, enabling the GNN to capture biologically relevant tumor-microenvironment interactions. Explainable artificial intelligence mechanisms, including attention visualization, Grad-CAM++, SHAP, and graph-based explanations, will be incorporated to provide interpretable evidence for model predictions and improve clinical transparency. The framework will be evaluated using accuracy, precision, recall, F1-score, area under the ROC curve, and interpretability-oriented analyses. By combining tissue morphology, spatial microenvironment information, clinical context, and model explainability within a unified architecture, the proposed approach aims to move beyond image-only black-box classification toward a transparent and clinically actionable computational pathology system for lung and colon cancer diagnosis, prognosis, and decision support. The principal contribution is the integration of diagnostic prediction, spatial biological modeling, prognostic assessment, and explainability in a single computational pathology workflow designed for reproducible evaluation and future clinical translation.

Keywords: Lung cancer, Colon cancer, Graph neural networks, Multimodal learning, Explainable AI

ForensicFed-IDS: Private Hybrid Detection and Response for IoT

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Internet of Things (IoT) traffic is distributed, heterogeneous, and privacy-sensitive, creating challenges for intrusion detection based solely on static signatures. This study proposes ForensicFed-IDS, a hybrid framework that links privacy-preserving detection with forensic evidence preparation and tiered threat response. The framework combines a calibrated support vector machine with an autoencoder-derived anomaly score. Discriminative and reconstructive evidence are fused into a validation-tuned detection score, while federated learning, secure aggregation, and differential privacy support distributed model development and explicit privacy protection. When the score crosses a decision threshold, the workflow initiates collection of volatile artefacts, attaches trusted timestamps, computes SHA-256 hashes, and records provenance before applying an appropriate response. This sequence connects detection with the preservation of information needed for subsequent investigation. The evaluation protocol includes client-level non-IID data partitions and unseen attack scenarios. Assessment covers detection performance, calibration, response time, privacy cost, communication cost, and forensic integrity. These dimensions reflect the need to examine operational behaviour and evidence handling alongside predictive performance. The framework explicitly recognises that federated learning alone does not establish the required level of privacy. Its contribution is an integrated workflow in which intrusion detection, privacy controls, evidence preparation, and mitigation are considered together. The proposed architecture provides a basis for examining how automated responses can preserve evidentiary and operational integrity in distributed IoT environments. The study presents a framework and evaluation protocol rather than numerical evidence of completed performance validation. It concludes that trustworthy automated protection requires coordinated assessment of detection quality, privacy guarantees, response behaviour, and the integrity of collected evidence.

Keywords: IoT security, Intrusion detection, Federated learning, Differential privacy, Digital forensics

An Explainable Multimodal AI Framework for Early Alzheimer's Disease Detection Using Large Language Models

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The early diagnosis of Alzheimer's disease (AD) is critical for early intervention, better patient management and individual treatment. Traditional AI methods, however, tend to be specific to a single type of data, like MRI scans or clinical assessment data, which only captures part of the complex and varied nature of early-stage disease. With recent developments in Large Language Models (LLMs), there are new opportunities to integrate and interpret multimodal clinical data, such as medical records, cognitive assessments, clinical observations and features derived from neuroimaging. We introduce a multimodal information integration based clinical reasoning framework for early diagnosis of Alzheimer's disease with the aid of LLMs, focusing on the aspects of interpretability and decision support. It introduces a structured clinical and cognitive information component, along with features derived from neuroimaging models, and utilizes an LLM-based reasoning layer to produce an initial risk assessment for AD and clinically interpretable explanations. The framework also takes into account the sensitivity of healthcare information and the need for privacy-preserving processing and deployment of patient information. The article explores how LLMs can contribute to the early detection, summarizes the current LLM-based works in Alzheimer's research, highlights the challenges with hallucination, reliability, data privacy, clinical validation, and bias, and provides future directions for research. The proposed framework will serve as a starting point for trustworthy and explainable LLM-assisted screening for Alzheimer's disease and underscore the critical importance of extensive clinical validation for the safe implementation of these tools in healthcare settings. The contribution is a proposed architecture rather than a clinically validated screening system.

Keywords: Large language models, Alzheimer's disease, Multimodal learning, Clinical decision support, Explainable AI

Artificial Intelligence and the Dynamics of Social Morality in Ian McEwan's Machines Like Me

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This study examines artificial intelligence and the development of social morality in Ian McEwan's Machines Like Me. The novel provides a literary setting for investigating how Adam, an artificial human, encounters moral expectations through relationships with human characters. The purpose is to explore how observation, social interaction, modelling, and experience contribute to his moral development. Grounded in Albert Bandura's social learning theory, the research uses qualitative textual analysis of selected interactions, dialogue, and ethical situations involving Adam. It focuses on the relationship between his artificial design and the behaviours, values, and conflicts he encounters within his social environment. The analysis interprets Adam's responses as part of an ongoing process of learning through social experience. The findings suggest that his moral development cannot be explained solely through the technical conditions of his creation. Human conduct and the ethical tensions of interpersonal relationships also shape the situations through which his moral dispositions are expressed. His responses complicate the distinction between learned morality and human moral agency, raising questions about how moral understanding develops through participation in a social world. The study therefore reads machine morality in the novel as a socially mediated process. Its contribution is to connect a social learning perspective with literary representations of artificial intelligence and ethical agency. It concludes that Machines Like Me provides a context for examining the interaction between artificial design and socially acquired moral behaviour. By centring observation, modelling, and experience, the analysis brings attention to the role of social relationships in representations of intelligent machines and the moral questions raised by their participation in human life.

Keywords: Artificial intelligence, Machines Like Me, Albert Bandura, Moral agency, Social learning

The Algorithmic Unconscious: Techno-Identity and the Psychoanalysis of Digital Transformation in Post-2020 Speculative Fiction

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As the digital transformation accelerates, Artificial Intelligence (AI) and intelligent learning algorithms have evolved beyond mere computational infrastructure, fundamentally reorganizing the architecture of the human psyche. This paper asserts that true digital transformation cannot be understood without a rigorous psychoanalytic intervention. Bridging post-structuralist theory, cybercriticism, and the humanities, this research introduces the "Algorithmic Unconscious" to interrogate how post-2020 speculative fiction narrativizes the profound psychological enmeshment between human subjects and machine logic. This paper argues that contemporary intelligent algorithms have usurped the traditional psychoanalytic symbolic order (the Lacanian "Big Other"). Rather than serving as passive tools, AI interfaces operate as structural repositories for human projective identification. Crucially, because AI relies on sequential mathematical optimization rather than human empathy, it functions as a psychological "failed container." The algorithm cannot metabolize emotional distress; it merely quantifies and reflects it back, trapping the user in a continuous feedback loop. It is within this inescapable loop that the modern "Techno-Identity" is forged. Moving beyond outdated concepts of escapist avatars, this paper defines Techno-Identity as a subjectivity that is continuously co-constructed during the dynamic "Screen Stage"—a state where identity survives only through algorithmic validation. Supported by Digital Humanities methodologies, including semantic network mapping, this research empirically visualizes the convergence of technological and emotional lexicons. Ultimately, this paper demonstrates that speculative fiction provides a vital psychoanalytic map of digital transformation, arguing that in the algorithmic age, the unconscious is no longer a hidden internal repository, but an externalized dataset that actively dictates human desire.

Keywords: Algorithmic unconscious, Techno-identity, Projective identification, Psychoanalysis, Digital transformation



SUSTAINABILITY, CLIMATE ACTION AND GREEN INNOVATION

ORAL

PRESENTATIONS

Transforming Food Systems for Sustainability: Tackling Malnutrition, Obesity and Climate Risks through Innovation

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Food systems are at the heart of interconnected global challenges, including malnutrition, obesity, food insecurity, and climate change. Current food production, processing, and consumption patterns affect both human health and environmental sustainability. Particular attention is given to the growing consumption of ultra-processed foods, food loss and waste, and their links to non-communicable diseases (NCDs), greenhouse gas emissions, and biodiversity decline. Addressing these challenges requires an integrated approach that recognizes the coexistence of hunger, micronutrient deficiencies, and obesity as part of a complex global nutrition transition. Climate change, socio-economic inequalities, and changing dietary habits further intensify pressures on food security, nutritional quality, and public health outcomes. Sustainable and innovative solutions offer significant opportunities to transform food systems. Strategies such as sustainable agricultural practices, food fortification, circular economy approaches, food waste reduction, sustainable packaging, and alternative protein development can simultaneously improve nutritional outcomes and reduce environmental impacts. Public policies that promote healthier diets and foster responsible food production and consumption also play a critical role in this transition. Achieving resilient and sustainable food systems will require coordinated action among governments, industry, researchers, and consumers. Such transformation is essential for improving global nutrition, mitigating climate risks, and advancing the Sustainable Development Goals.

Keywords: Sustainable food systems, Obesity, Climate change, Green innovation, Ultra-Processed foods

Addressing Water Quality in a Changing Environment: Smart Tools for Urban Water Management

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Urban water systems face increasing pressure from population growth, climate change and ageing centralised infrastructure. Managing these systems effectively depends on turning environmental data into reliable knowledge and decisions, through a chain that links monitoring networks, sensors and IoT technologies with models, visualisation tools and stakeholder involvement. This presentation discusses the role of data and models in urban water management, the sources of uncertainty in modelling (data, structural and parameter errors), and the risk that a model or Digital Twin may perform well for the wrong reasons. These issues are illustrated through an application to the Greater Athens Area, a Mediterranean metropolitan region of approximately 3.8 million inhabitants. A daily urban water balance model, acting as a Digital Twin of the urban water cycle, was used to integrate the potable supply–wastewater and rainfall–stormwater networks. Model outputs were compared with measured daily imported water and wastewater discharge data. Three decentralised water saving strategies were evaluated against a base case: on-site rainwater harvesting, on-site wastewater treatment and reuse, and subsurface greywater irrigation. The results show that decentralised on-site technologies can substantially reduce freshwater withdrawals and urban discharges. They also show that Digital Twins are valuable tools for developing flexible, climate-resilient water management strategies. How widely these strategies can be applied depends on user awareness, economic incentives and a more detailed representation of the catchment.

Keywords: Urban water management, Digital Twin; Water balance modelling; Decentralised water reuse, Climate change

Seasonal Variability Analysis of the Air Quality in Lahore

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Lahore has been among the list of most polluted cities in terms of air quality for past several years. The concentrations of particulate matter adversely affect the air quality and human health. This study focused on assessing the air quality in a densely populated area of Lahore having high population density, traffic density and congestion zones, a landfill site and large cluster of informal industry. All these are known to be among the major contributors to ambient air pollution. In this research work, a low cost and locally built air quality module was utilized for the continuous monitoring of ambient air quality. Meteorological parameters such as temperature and relative humidity and concentrations of air pollutants such as CH4, NH3 and particulate matter (PM1, PM2.5 and PM10) were measured. The data was collected for a period of one year from March 2022 to February 2023. US EPA Air quality indices (AQI) based on daily averages of PM2.5 concentrations were calculated and analyzed. The summers are the best months in terms of air quality with AQI ranging between 20 and 70, whereas the winters are considered the worst with AQI values ranging from 80 to 180 consistently. The back trajectories were studied in the periods when the pollutants concentrations were alarmingly high. It was found that trans-boundary pollution occurred during Monsoon and Spring period. A health risk assessment was also carried out based on the methodology specified by US EPA. Hazard quotient was calculated with reference to the exposure limits specified by both WHO and Punjab Environmental Quality Standards (PEQS) for infants, children and adults. It was found that the infants, children and adults were all at high risk of exposure in reference to the WHO limits during spring, summer and monsoon. In autumn and winter period, the pollution levels were so high that the hazard quotients marked air quality worst for all age groups on both WHO and PEQS guideline values.

Keywords: Air quality, Particulate matter, Health risk assessment

Climate-Driven Nutrient Depletion: Dietary Risks and Food-System Adaptation Beyond Yield Loss

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Climate change has not only exacerbated threats to food systems, but its consequences extend beyond agricultural productivity to the nutritional profile of crops. There is an advancement in designing a framework linking climate change, plant-soil responses, nutrient-density change, food bioavailability, dietary exposure, nutritional risk, and adaptation. Evidence across physiological, agronomic, food sector, and nutrition domains is analyzed to identify the mechanistic explanation of climate stress propagation from crops to human diets rather than addressing individual climatic stressors and crop responses as isolated phenomena. Evidence on climate-driven reductions in crop nutrients indicates that yield stability does not necessarily ensure nutritional stability, as climatic stress can alter nutrient acquisition, allocation, accumulation, and interactions with other components of the food matrix. The translation of these crop-level changes into human nutritional risk remains insufficiently characterized, particularly with respect to nutrient bioavailability, dietary exposure, and population-specific vulnerability. This signifies a critical gap between evidence of altered crop composition and quantification of its consequences for human nutrition. Current adaptation strategies, *i.e.*, climate-resilient breeding, agronomic biofortification, optimized soil and nutrient management, irrigation management, crop diversification, and CRISPR-based gene editing, enable more precise characterization of nutrient-resilient crop traits. The evidence therefore necessitates a predominantly production-centred model of climate adaptation toward an integrated crop-nutrition approach, in which nutritional quality is treated as a measurable component of agricultural resilience. Climate-nutrition resilience provides a conceptual basis for linking productivity, nutrient density, bioavailability, dietary exposure, and adaptation, with the potential to align agricultural innovation with nutritional security, environmental sustainability, and the Sustainable Development Goals.

Keywords: Climate change, Environmental stressors, Nutrient dilution, Elevated CO2, Heat stress

Mycorrhizal Fungi–Glomalin Synergy Restrains Cadmium Uptake and Boosts Pea Productivity in Contaminated Soils

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Cadmium (Cd) contamination in agricultural soils is a growing concern because it can affect soil quality, crop productivity, food safety, and groundwater. This study examined whether arbuscular mycorrhizal fungi (AMF) and easily extractable glomalin (EG) could work together to reduce Cd mobility and uptake while improving pea growth and soil health. A pot experiment was conducted using Cd-polluted soil collected from agricultural fields receiving untreated pottery-industry effluents. Four treatments were compared: an untreated control, AMF, EG, and the combined AMF+EG treatment. Among the treatments, AMF+EG gave the most pronounced improvements. It reduced bioavailable Cd in the soil and Cd accumulation in pea shoots, roots, and grain by 64%, 68%, 53%, and 89%, respectively, compared with the control. Under AMF+EG, Cd concentrations in pea grain and leachates were also reduced below the reported FAO/WHO and WHO permissible limits. The combined treatment improved plant performance, increasing shoot dry weight, root dry weight, pod number, and grain yield by 36%, 60%, 144%, and 58%, respectively. It also improved grain nutritional status, with increases in P, K, Ca, Mg, Fe, Zn, and Mn. In addition, AMF+EG enhanced soil biological activity, increasing β-glucosidase, urease, catalase, chitinase, and phosphomonoesterase activities by 68%, 72%, 206%, 87%, and 172%, respectively. Overall, the findings indicate that the combined use of AMF and EG can limit Cd movement from soil to plants and leachates, while supporting pea productivity, grain nutritional quality, and soil biological functioning. This approach therefore shows promise as a sustainable strategy for managing Cd-contaminated agricultural soils.

Keywords: Cadmium; Arbuscular mycorrhizal fungi; Easily extractable glomalin; Soil remediation; Soil health

Mapping the Antimicrobial Resistance Landscape: A Bibliometric Analysis of One Health-AMR

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Antimicrobial resistance (AMR) is a complex One Health challenge at the intersection of human, animal, agricultural, and environmental systems. This study maps the global AMR research landscape, with emphasis on environmental surveillance, collaboration, and sustainability. A bibliometric analysis was conducted using 12,150 Scopus-indexed English articles and reviews published between 2016 and 2025. Descriptive bibliometrics, geographic and funding analyses, co-authorship networks, institutional collaboration mapping, and author-keyword co-occurrence with temporal overlay were performed using VOSviewer. Annual publication output increased nearly sevenfold, from 315 papers in 2016 to approximately 2,175 in 2025. Research was concentrated in the United States, China, the United Kingdom, and India, whereas sub-Saharan Africa, Southeast Asia, Central and South America, and Eastern Europe remained underrepresented. Medicine and microbiology dominated, but contributions from veterinary, agricultural, and environmental sciences increased. Keyword trends indicated a shift from pathogen characterization and resistance mechanisms toward environmental monitoring, antimicrobial stewardship, policy, equity, climate interactions, and digital health. International collaboration strengthened, although geographic equity, environmental representation, and cross-sectoral integration remained uneven. Future priorities include interoperable human–animal–environment surveillance, stronger research capacity in underrepresented regions, and implementation-focused partnerships to support One Health action and the Sustainable Development Goals.

Keywords: Antimicrobial resistance, One Health, Bibliometric analysis, Environmental surveillance, VOSviewer

Nature-Inspired Biopesticides for Control of Pests on Cotton and Other Crops under Organic and Regenerative Agriculture Models

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There are emerging as well as established facts that chemical pesticides are resulting in issues in human health and damage to environment. The progress in genomics and metabolomics of insect pests have identified new solutions based on nature. Similarly, several plants and their extracts are historically known to have insecticidal activity but their use on large scale requires standardization and industrial scale production. In order to better understand and develop standardized biopesticides, whole genome and metabolome of three plants including *Rhaza stricta*, *Calotropis procera* and *Citrullus colosynthis* is being studied. The knowledge generated has been used to develop biopesticides and have been found to be effective under controlled and field conditions. Another nature-inspired pesticide is Hvt, a small insecticidal protein from Australian funnel web spider that has been extensively studied and its biosafety is well established. This protein and some of its variants have been cloned for large scale production in Pichia pastoris and formulation as biopesticides. A collaborative arrangement with synthetic chemists of ICCBS has developed pheromones and lures for control of insect pesticides. These nature-based solutions are important component of organic and regenerative agriculture models for sustainable exports of textiles, grains, fruits and vegetables and health of farmers and consumers in the country.

Keywords: Biopesticides, Organic agriculture, Cotton pest control

Towards Developing an Artificial Intelligence-Based Monitoring System for Water Quality Indicators

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The growing availability of computational resources and online tools has opened new opportunities for using machine learning in wastewater treatment. This study explored the use of artificial intelligence models to predict influent biochemical oxygen demand (BOD) using actual operating data from a sequential batch reactor (SBR) wastewater treatment plant in the Philippines. Several data preprocessing techniques were applied, including the Yeo–Johnson transformation, which helped improve the distribution of the data and reduce bias and variance. Feature selection identified chemical oxygen demand (COD), ammonium nitrogen (NH_4-N), and phosphate (PO_4-P) as the three most useful influent parameters for predicting BOD. Three neural network models—deep neural network (DNN), long short-term memory (LSTM), and convolutional neural network (CNN)—were then developed and optimized using Bayesian optimization. Among these models, DNN showed the best generalization performance, with an R^2 of 0.35. For the ensemble models, XGBoost (XGBM) performed better than LightGBM (LGBM), achieving an R^2 of 0.25. While the predictive performance of the models can still be improved, the results showed the potential of artificial intelligence as a tool for monitoring and predicting water quality indicators in wastewater treatment plants. With further model development and validation using more extensive datasets, these approaches could eventually support real-time decision-making and more proactive management of SBR-based municipal wastewater treatment plants in the Philippines.

Keywords: Biological wastewater treatment, Artificial Intelligence, SBR

From Research to Regeneration: Driving Climate Action through Green Innovation and Circular Economy

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The climate crisis is not only a challenge of emissions, waste and resource depletion; it is a challenge to the very way we design our economies, industries and institutions. The next generation of climate action must therefore move beyond incremental efficiency towards circularity, regeneration and systems-level transformation—where waste becomes a resource, research becomes enterprise, and sustainability becomes a driver of economic opportunity. This keynote draws upon a portfolio of interconnected initiatives demonstrating how such transformation can emerge from developing economies. The SAFER Plus project explores the conversion of agricultural residues into bio-coal, renewable energy and value-added products, creating pathways for industrial decarbonisation, cleaner energy and rural value creation. Research on banana pseudo stem fibers illustrates how agricultural waste can be transformed into sustainable textile materials through improved extraction and treatment technologies, opening possibilities for new circular material value chains. Within Pakistan's textile sector, interventions in the Satiana recycling cluster address an equally important challenge: ensuring that recycling itself becomes cleaner, safer and more sustainable. Through improved processing, chemical management, wastewater treatment and environmental compliance, textile waste can be reintegrated into productive cycles with a lower environmental footprint. These efforts converge within the broader vision of Circular Faisalabad—a regional ecosystem in which universities, industry, government, SMEs, innovators and communities work together to redesign material and energy flows, accelerate cleaner production, create green jobs and foster circular entrepreneurship. The central proposition is that climate action should not be perceived merely as an environmental obligation. Properly designed, it can become a powerful engine of innovation, competitiveness, resilience and inclusive regional development. The real transition is not simply from fossil to renewable, or from waste to recycling; it is from linearity to circularity, from sustainability to regeneration, and from isolated projects to integrated ecosystems of green transformation.

Keywords: Climate action, circular economy, green innovation, SAFER Plus, biomass valorisation

Eco-Friendly Treatment of Textile Wastewater Using Banana Peel and Neem Extract as Sustainable Natural Coagulants

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Textile dyeing effluents contain substantial suspended solids, dissolved pollutants, dyes, and potentially toxic heavy metals, posing serious environmental concerns when discharged without adequate treatment. This study investigated the potential of plant-based waste and biomass as natural coagulants for sustainable textile wastewater treatment. Three natural coagulants—banana peel powder (*Musa* sp.), neem leaf powder (*Azadirachta indica*), and a 1:1 banana peel–neem leaf composite—were evaluated using coagulation–flocculation treatment. Wastewater samples were treated under varying initial pH conditions (4–10) and coagulant doses (0.2–1.0 g). Treatment performance was assessed by measuring pH, electrical conductivity (EC), dissolved oxygen (DO), total dissolved solids (TDS), turbidity, and heavy metals, including cadmium (Cd), iron (Fe), and chromium (Cr). The composite coagulant demonstrated the greatest TDS removal, reducing TDS from 0.113 to 0.017 kg/m³ at pH 8, together with the highest reduction in EC. DO remain largely unchanged after treatment, indicating that the process primarily removed suspended and dissolved pollutants rather than increasing oxygenation. All three coagulants reduced Cd, Fe, and Cr concentrations to below National Wastewater Quality Standards (NWWQS) reference levels under most tested conditions. The composite generally produced the lowest and most consistent heavy-metal concentrations, although Fe exceeded the relevant limit at higher pH and Cr exceeded the limit at the lowest dosage. Neem leaf powder generally showed lower performance than the other treatments. The findings demonstrate that banana peel, neem leaf, and their composite are promising low-cost, renewable, and eco-friendly natural coagulants for textile wastewater treatment. Banana peel powder performed particularly well across physicochemical parameters, while the composite showed advantages for TDS and heavy-metal removal. Further optimization is recommended to improve pollutant removal and facilitate scale-up for sustainable textile wastewater management.

Keywords: Sustainable water treatment, Natural coagulants, Agro-waste valorization, Banana peel, Heavy metal removal

Green Innovation for a Sustainable Future: Connecting Industry and Academia for Climate Action and Sustainable Development

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A fundamental change in our understanding of the connections between environmental sustainability, economic activity, human health, and technological innovation is necessary for the pursuit of sustainable development. Economies, communities, and future generations are facing interrelated issues due to climate change, resource depletion, environmental degradation, and growing urbanization. In order to address these issues, new, resource-efficient, low-carbon, and environmentally conscious development models must be adopted in addition to technology advancements. By combining scientific understanding, sustainable production, cutting-edge technology, renewable energy, circular economy concepts, and ethical business practices, green innovation offers a decisive route. While industry offers real-world experience, funding, technological adoption, and avenues for scaling solutions, universities and research institutions produce talent and information. Therefore, strong industry-academia collaboration can turn research into useful solutions that improve climate resilience, lessen environmental damage, generate green jobs, and support sustainable economic growth. The keynote will also focus on the role of industry in building practical platforms for innovation, entrepreneurship, and technology commercialization, as well as the role of universities in producing human capital prepared for the future. Industry-Academia ecosystems have the potential to become potent catalysts for climate action and sustainable development by linking knowledge, innovation, investment, policy, and implementation, supporting the achievement of the Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation and Infrastructure), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

Keywords: Green Innovation, Sustainability, Climate Action, Industry–Academia Collaboration, Circular economy

Analysing the Synergistic Effects of Agrowaste-Derived Organic Amendments for the Growth, Yield and Cadmium Mitigation in Rice (*Oryza sativa* L.)

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In this study, the efficacy of a novel combination of rice-husk biochar (BC) and farmyard manure (FYM) and sugarcane press mud (PM) in alleviating cadmium (Cd) toxicity and improving rice (Oryza sativa L.) growth, physiological performance, antioxidant defense, nutrient acquisition, and Cd accumulation was evaluated. Several BC-based amendments with FYM and PM were applied to rice plants. The growth and biomass of plants, water use efficiency, oxidative stress indicators, antioxidant enzyme activity, nutrient concentrations, and Cd accumulation in roots, shoots, and grains, were assessed. To identify treatment-dependent relationships between physiological, biochemical, and Cd-related responses, multivariate analyses were conducted. Rice performance under Cd stress was significantly improved by applying FYM + 1.0% BC combined. Shoot length increased by 9.28%, while root, shoot, and grain biomass and spike length also increased. Net photosynthetic rate and water-use efficiency increased by 117.25% and 114.71%, respectively. In addition to reducing malondialdehyde (MDA), electrolyte leakage, and H_2O_2, FYM + 1.0% BC significantly enhanced superoxide dismutase, peroxidase, and catalase activities. In shoots, Cd accumulation declined by 83.03%, in roots, by 65.88%, and in grains, it declined by 64.11%. PM + 1.0% BC promoted greater accumulation of micronutrients, notably Fe, Zn, Mn, and B, while FYM + 1.0% BC exhibited greater physiological and biochemical responses. As a result of FYM + 0.1% BC, Cd toxicity was effectively mitigated by restricting Cd uptake, strengthening antioxidant defense, improving nutrient acquisition, and enhancing rice productivity, demonstrating its potential as a sustainable amendment for soils contaminated with Cd.

Keywords: Soil organic amendments, Agrowaste, Rice crops, Cadmium, Health risks

Unveiling Lahore's Air Pollution Crisis: Source Apportionment and Strategic Mitigation Pathways

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Severe air pollution and seasonal smog pose critical public health and environmental challenges across urban centers in Pakistan, particularly in Lahore. Ambient concentrations of fine particulate matter (PM2.5) consistently exceed National Environmental Quality Standards (NEQS) and World Health Organization (WHO) guidelines, reaching levels up to 38-fold higher than WHO limits. Health risk evaluations reveal that Daily Dosage rates for sensitive populations far surpass allowable thresholds, yielding Health Hazard Quotients (HHQ) between 10 to 50 times above reference levels and contributing to an estimated loss of 3.7 to 4.6 years in life expectancy for Lahore residents. Source apportionment studies indicate that vehicular emissions (~33%), biomass burning (~25%), and industrial activities including coal combustion (~22%) represent the primary drivers of degraded air quality. Addressing this persistent crisis demands an integrated, short- to long-term intervention framework combining technological innovation, multi-sectoral collaboration, and targeted policy reform. Key technical solutions include deploying low-cost sensor monitoring networks, establishing specialized smog chamber facilities, developing indigenous particulate filters, and converting agricultural residues into solid fuels. Concurrently, policy measures must enforce mandatory vehicular testing via the Punjab Vehicular Inspection and Certification System (VICS), transition from Euro II to Euro VI emission standards, promote sustainable agricultural practices to replace field burning, and execute widespread public awareness campaigns. Synergizing academic research, industrial innovation, and governmental enforcement via a triple-helix model provides a viable roadmap to mitigate toxic air pollution, protect public health, and build long-term environmental resilience in Pakistan.

Keywords: Air pollution, SMOG, PM2.5, Mitigation

Toxicity Risk Assessment: A Strategy for Sustainable Chemical and Bio-Material Development

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The widespread applications of various materials developed under sustainability, climate action, and green innovation including, bioproducts, agrochemicals, pharmaceuticals, nano-formulations, and other materials have raised public concerns about their impact on human health and environment. Hence, toxicity risk assessment of the products, are of the utmost importance for their safe uses. Toxicity testing provides many of the data needed for risk assessment. A "battery" of tests is being used for toxicological evaluation comprises, the systemic/local toxicity in laboratory animals (*in vivo*), ecotoxicity by acute fish toxicity-LC50. At the gene level, mutagenicity by the bacterial reverse mutation assay (Ames test) with reference strains of *Salmonella typhimurium*, and the molecular level, genotoxicity is evaluated by the comet & Micronucleus assay. Recent years, new approach methods (NAM) based on *in vitro* (cell culture) tests, *in silico* (computational modeling), and the *Pig-a* (phosphatidylinositol glycan, Class A) gene mutation assay have shown promise for regulatory applications, including integration of gene mutation detection. The safety profiling of the newly developed products is important to identify and characterize the possible adverse effects of product/chemical exposures based on their relative toxicity and is a primary requirement of regulatory bodies such as the Department of Plant Protection (DPP), DRAP, EPA, etc., for product's registration before commercialization, ensuring compliance with national and international regulatory requirements. In Pakistan, only limited sectors are providing toxicity testing to address challenges in product safety compliance. The Toxicity Testing Lab, NIBGE, has been ISO/IEC 17025:2017 accredited (No. 261) by PNAC since 2022 and has characterized various agrochemicals (pesticides), GM crops, and other materials through a battery of toxicity tests. It supports various biosafety-based R&D and provides services to various stakeholders at the national level to support regulatory bodies and contributed to socio-economic impact and enhance trade of the country.

Keywords: Toxicity, Genotoxicity, Sustainable products, Regulatory compliance

Whitefly Expansion under Changing Climate: Genomic Adaptation, Virus Association and Sustainable Management in Punjab, Pakistan

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The whitefly, *Bemisia tabaci*, is an important agricultural pest because of its wide host range, rapid adaptation and ability to transmit several economically important plant viruses. The present study focused on the geographical distribution of whitefly populations in Punjab, Pakistan, their association with plant viruses, and their increasing occurrence on different crop hosts. Whitefly samples were collected from different cropping areas and host plants in Punjab and evaluated for their distribution and association with begomoviruses. Field observations were also made on soybean, where whitefly populations persisted despite applications of different insecticides, including indoxacarb. Whitefly populations were found across diverse cropping environments, indicating their ability to survive beyond the host plants on which serious infestations have traditionally been reported. The persistence of whiteflies following insecticide application further indicated the limitations of relying only on chemical control. The remarkable adaptability of *B. tabaci* may be partly supported by its genetically diverse detoxification mechanisms. Genomic studies have shown that whiteflies possess plant-derived genes acquired through horizontal gene transfer, including genes involved in neutralizing plant defensive compounds. Such genomic adaptations, together with continuous selection pressure from insecticide use, may contribute to the survival and expansion of whitefly populations across different hosts and environments. These findings highlight the need for continuous molecular surveillance of whitefly populations and their associated viruses in Punjab. Integration of geographical monitoring, molecular identification, virus detection and insecticide-resistance assessment will be important for developing more effective and sustainable whitefly management strategies.

Keywords: Whitefly, Resistance, Detoxification, Punjab, Soybean

Achievement of Sustainable Development Goals (SDG's) in Context of Educational Gender Equality

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This study assessed how effectively Sustainable Development Goals SDG-4 and SDG-5 working in Pakistan, with a focus on female students in an urban-industrial context. Data were collected from 145 BS Education students from a population of 232 students of Faculty of Social Sciences, UAF. Data were collected through pre-tested questionnaire and analyzed through SPSS. Findings showed that students have a moderate general understanding of gender equality. However, their knowledge about national gender equality laws was low (M = 2.07), and they had limited awareness of government programs related to gender equality (M = 2.13). The university was found to play only a moderate role in promoting gender equality, with support systems and facilities having the lowest score in the study. Economic and employment barriers had the highest section score (M = 3.67). A Pearson correlation analysis found a strong positive link between students' awareness and the academic environment ($r = 0.642$, $p < .01$). A multiple regression analysis showed that student awareness and the academic environment together explained 50.7% of the variation in gender equality outcomes ($R^2 = 0.507$, $F = 58.24$, $p < .001$). The study found that UAF has made noticeable improvements in the number of women enrolling in its programs. However, still there are many problems for female students and faculty as well. To address these problems, the study suggested establishing a gender equality office, training course, and gender focused budgets. These steps were intended to help close the gap between what Pakistan promises through its SDG goals and the real experiences of female students in public higher education.

Keywords: SDGs, gender, Equality, Education

Synergistic Effects of Biochar and PGPR Modulate Peanut Physiology and Metabolism to Mitigate Drought Stress with Reduced Synthetic Nitrogen

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Drought stress is a major constraint for peanut (*Arachis hypogaea* L.) production in arid and semi-arid environments. To alleviate drought induced growth and yield losses, farmers often rely on high nitrogen (N) application. However, this approach has economic and environmental concerns. This study aimed at optimizing N dose (30, 15, 0 kgNhac^{-1}) with organic sources i.e. biochar (BC) 2% and 1% w/w and Biozote-max (BZ) to improve plant performance under drought. Combined application of BC and BZ integrated with reduced N doses significantly improved root and shoot biomass, leaf area, relative water content, stomatal conductance and chlorophyll content both in frequent and limited water regime than locally practiced 60 kgNhac^{-1}. However, integrated application of 2%BC + BZ+15 kgNha^{-1} and 1%BC + BZ+30 kgNhac^{-1} better maintained counterpart plant water status and gas exchange under drought than in frequent water. Gas chromatography mass spectroscopy (GCMS) analysis of superior performing treatment (1%BC + BZ+30 kgNha^{-1}) revealed activation of hexosamine biosynthesis pathway reflecting primary metabolic adjustments in roots. While high nitrogen application shifted plants to secondary metabolism characterized by upregulation of tyrosine metabolism in roots under drought. Hence, this study demonstrates that integrating biochar, biozote-max and nitrogen particularly 15 or 30 kgNhac^{-1} is more effective strategy for alleviating drought effects and sustaining plant primary metabolism in limited water.

Keywords: Climate change, Organic amendments**,** Metabolism**,** *Arachis hypogaea***,** Nitrogen reduction

Green Banana Powder: A Multifunctional Excipient for Sustainable Nutraceutical Production

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Excipients are inactive substances that are incorporated into pharmaceutical and nutraceutical formulations to facilitate the manufacturing process, enhance stability, performance, acceptability, and delivery of the active ingredient. Growing demand for functional excipients has shifted attention away from conventional inert excipients toward functional excipients that offer both technological performance and health-related benefits. This shift is especially relevant to the development of sustainable, clean-label nutraceutical products, creating demand for plant-based excipients with multifunctional properties. Green banana powder is well suited to this emerging need. Its starch-rich composition allows it to function as a binder, disintegrant, and diluent, enabling a single plant-based material to serve multiple formulation roles at once. As a binder, it helps hold powder particles together, giving tablets the strength and cohesion needed to withstand handling. As a disintegrant, it enables tablets to break apart efficiently once ingested, supporting timely release of the active ingredient. As a diluent, it adds the necessary bulk to formulations where the active ingredient alone is too small to be processed effectively. This three-in-one functionality, derived from its highly resistant starch content, allows green banana powder to replace multiple conventional excipients with a single plant-based material. Beyond this technological function, its resistant starch and dietary fiber may support gut and metabolic health, further strengthening its relevance for nutraceutical applications. Using green banana powder also offers a way to convert surplus and underutilized green bananas into a value-added functional ingredient, helping reduce agricultural losses and supporting more sustainable production practices. In addition, developing green banana-based excipients locally could reduce reliance on imported formulation materials while promoting agricultural value addition, local manufacturing, and industrial growth. Overall, green banana powder represents a promising multifunctional, plant-based, and sustainable excipient that aligns with the rising demand for functional excipients and holds real potential for advancing clean-label, health-oriented nutraceutical formulations.

Keywords: Functional excipient, Green banana powder, Resistant starch, Sustainable production

SUSTAINABILITY, CLIMATE ACTION AND GREEN INNOVATION

POSTER

PRESENTATIONS

Enhancing Climate Sustainability via Green Innovations in the Bioremediation of Oil Sludge Using Microbial Consortium and Bio Surfactants

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The rapid growth of global industrialization has led to an exponential increase in oil sludge and petroleum-rich wastewater, creating severe environmental pollution and public health risks in densely populated industrial cities. To address this, eco-friendly green innovations and sustainable waste-management frameworks are being developed to revolutionize the treatment of hazardous industrial effluents. Among these advancements, bioremediation utilizing microbial consortium has emerged as a highly effective approach. Compared to single-species applications, microbial consortium demonstrate an 89% to 94% increase in hydrocarbon degradation efficiency due to synergistic metabolic pathways that completely mineralize complex pollutants. However the microbes are still not able to work effectively due to bioavailability issues. This is mainly because of the low solubility of hydrophobic contaminants and microbes. However the issues of bioavailability is overcome by application of biosurfactants which enhance the solubility and emulsification of hydrophobic substrates and microbes. Furthermore, the operational stability of these consortium is maximized through advanced in-situ bioprocess engineering techniques, including, Suspended growth systems, Optimizing mass transfer in liquid phases via continuous agitation, Attached growth systems (biofilms) and hybrid growth configurations. By implementing these closed-loop green technologies, treated refinery wastewater can be recirculated back into industrial processes or safely discharged into municipal bodies. This aligns industrial waste management with the core principles of the circular economy and sustainable environmental engineering.

Keywords: Microbial Consortium, Green innovations, sustainability, Bio surfactants, Oil Sludge Treatment

Exploring Ecological Crisis and Political Denial in Netflix Series *Don't Look Up* (2021)

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This study examines how ecological crisis are not merely a science-fiction scenario but a politicized reality shaped by corporate interests, media trivialization, and political denial. It aims to explore how the film represents institutional failure in responding to environmental threats and highlights the consequences of collective inaction. This study employs Greg Garrard's ecocritical framework to analyze *Don't Look Up* (2021), focusing particularly on the concepts of pollution, political ecology, environmental justice, and apocalypse. The analysis further shows that misinformation, political distraction, and media sensationalism weaken public awareness and obstruct effective collective responses to environmental crises. The study also highlights the importance of 21st-century competencies, particularly critical thinking, media and digital literacy, informed decision-making, adaptability, and responsible citizenship, in addressing complex global challenges. The findings reveal that political power, corporate profit, media entertainment, and economic interests are prioritized over environmental responsibility. The study concludes that *Don't Look Up* (2021) functions as a cultural critique of institutional inaction and political denial. It emphasizes the need for future-oriented skills, environmental awareness, critical thinking, and responsible citizenship to respond effectively to environmental and sociopolitical challenges in the 21st-century. By exposing these interconnected failures, the film demonstrates how political and media systems can shape responses to environmental emergencies and influence collective action.

Keywords: Political denial, Ecological crisis, Corporate greed, Media trivialization

Federated Learning-Based Regression with XAI for Transparent Climate Change Analysis

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One of the most pressing issues in the world today is climate change as the number of greenhouse gas emissions increases and the temperature deviates. In this work, the authors make use of the climate change dataset with the purpose of predicting and classifying the environmental conditions through the advanced machine learning and federated learning strategies. XGBoost, LightGBM, and Support Vector Machine with RBF kernel three regression and classification models were used to analyze the relationship between temperature and CO 2 emissions and other indicators of the environment. On the training data, XGBoost attained the highest predictive accuracy of 99.37% and LightGBM (98.78% and SVM_RBF 97.45%) on predictive accuracy. Also, the XGBoost model has the lowest error rates, MAE = 0.51 and RMSE = 0.72, which proves that the model is highly reliable. A federated learning architecture was used to improve the information privacy and distributed learning, and allowed the model training to be performed on many nodes without storing sensitive information in a central location. Moreover, the Explainable Artificial Intelligence (XAI) models such as LIME and SHAP were used to explain model predictions and to find out the most significant environmental features that relate to the effects on temperature changes. Federated learning coupled with XAI offers a predictable, safe and understandable method of climate prediction. On balance, the suggested methodology can have a high potential of building trustworthy, privacy-protecting, and interpretable AI systems to forecast climate changes and make the environmental decisions.

Keywords: Climate change, Temperature prediction, Federated learning, XAI, Environmental data analysis

Intergenerational Microbic Dysbiosis: Effects of Parental Pesticide Exposure Changes the Gut Liver Axis in Offspring for Metabolic Syndrome

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Exposure to pesticides is an increasingly identified environmental contributing factor for metabolic dysfunction, its consequences may extend beyond closely exposed individuals to future generations through gene regulations and microbiome mediation. The aim of this study is to analyse whether exposure with pesticides induces gut microbiome dysbiosis and offspring axis reprograming, consequently higher chances to metabolic syndrome. Animal studies were given strong evidence on parental pesticide exposure associated changes in offspring. Various research administered a defined dose of pesticide to intervention group before mating. Progeny was observed until adulthood and evaluated for metabolic alternat junction proteins evaluate the integrity of intestinal barrier. Liver enzymes, proteins used in glucose metabolism, markers of insulin sensitivity and bile acid signalling for alteration in liver cells functioning, oxidative stress indicators and hepatic lipid accumulation were measured to assess liver inflammation and phenotype changes. 16S rRNA gene sequencing was used for profiling gut microbiome through parental and offspring fecal samples. Serum and fecal saturation microbiome metabolites such as tryptophan, bile acid and short chain fatty acid were also quantified by using targeted chromatographic and biochemical assays investigate gut liver axis. Metabolic syndrome in offspring was investigated by using adiposity measurements and body weight, insulin and fasting glucose, lipid profile, oral glucose tolerance testing. Mediation and correlation analysis were used and microbial alterations found and microbial metabolites were linked with metabolic abnormalities in offspring and found 60% elevation in oxidative stress indicators, 20- 55 % alleviation in insulin sensitivity markers, 30-65% elevation in lipid accumulation in hepatic cells.

Keywords: Metabolic syndrome, Dysbiosis, pesticide effects, 16S rRNA gene sequencing

A Study of Heterosis and Combining Ability to Develop Health Beneficial Sunflower Cooking Oil

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The current study used a line × tester mating design to assess sunflower heterosis and combining capacity at the Rajawala Research Station, University of Agriculture, Faisalabad. The experimental material consisted of four female lines, A-13, A-15, A-17 and A-19, and three male testers, R-21, R-23 and R-25. Twelve F_1 hybrids were created by crossing these parental genotypes. Eight yield and yield-related characteristics, such as plant height, number of leaves per plant, leaf area, internodal distance, stem diameter, head diameter, 100-achene weight, and seed yield per plant, were assessed for the parents and their hybrids in three replications. There was genetic heterogeneity among the sunflower genotypes, according to analysis of variance. Genotypes, crosses, parents, lines, testers, and the line × tester interaction all indicated highly significant differences in plant height. Other traits, including number of leaves per plant, internodal distance, stem diameter, head diameter, 100-achene weight and seed yield per plant, also showed variation among different sources. Proportional contribution analysis indicated that female lines contributed more to head diameter, seed yield per plant and 100-achene weight, whereas testers contributed mainly to stem diameter. Plant height, leaf area, number of leaves per plant, and internodal distance were all more influenced by the line × tester interaction, indicating the involvement of non-additive gene action in these characteristics. Line A-19 showed better response for plant height and number of leaves per plant, while A-15 was useful for stem diameter and A-17 for internodal distance. Among testers, R-25 showed better combining ability for plant height, leaf area and seed yield per plant, whereas R-23 was favorable for number of leaves per plant, stem diameter, head diameter and 100-achene weight. Specific combining ability and heterosis results indicated that A-13 × R-21, A-15 × R-25, A-13 × R-23, A-17 × R-25 and A-19 × R-23 were promising cross combinations. In order to create superior hybrids with increased yield potential, these parents and hybrid plants will be helpful in producing best cooking oil for the increasing population to fulfill the kitchen requirements.

Keywords: Sunflower, Line × tester analysis, Combining ability

Quantifying Performance Achievements and Gaps in Heavy-Metal Removal from Industrial Wastewater

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Heavy-metal contamination of industrial wastewater remains a persistent environmental challenge because metals such as Pb, Cd, Cr, Hg, As, Ni, Cu, and Zn are toxic, non-biodegradable, and can bioaccumulate. Although numerous treatment technologies have demonstrated high removal efficiencies, direct comparison of their practical performance remains difficult because wastewater composition, metal concentration, operating conditions, performance metrics, and experimental scale vary substantially. This review quantitatively examines the performance achievements and remaining gaps of major heavy-metal removal technologies, including chemical precipitation, coagulation–flocculation, adsorption, ion exchange, membrane separation, electrochemical treatment, photocatalysis, biological processes, and emerging hybrid systems. This report critically evaluates reported performance in terms of removal efficiency, adsorption capacity, selectivity, treatment time, regeneration and reusability, energy and chemical demand, secondary-waste generation, metal-recovery potential, and scalability. Advanced adsorbents and nanostructured materials frequently achieve high capacities under optimized conditions, while membrane and ion-exchange systems offer strong separation and selectivity. Electrochemical technologies provide additional opportunities for simultaneous metal removal and recovery, whereas hybrid processes can exploit complementary mechanisms to improve treatment performance. However, these achievements often come with important limitations, including membrane fouling, adsorbent regeneration losses, electrode passivation, high material or energy costs, sludge generation, and reduced selectivity in complex matrices. A key performance gap remains between results from synthetic single-metal solutions and those from real industrial effluents containing competing ions, organic matter, salts, and metal complexes. By integrating treatment achievements with technological limitations and application readiness, this review provides a comparative framework for identifying robust, scalable, and resource-efficient strategies for heavy-metal management in industrial wastewater.

Keywords: Heavy metals, Industrial wastewater, Removal technologies, Performance benchmarking, Adsorption

Climate Action and Green Innovation for Sustainable Economic Development in Pakistan: Challenges, Opportunities and Policy Pathways

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Green innovation, including renewable energy technologies, energy-efficient systems, cleaner production processes, and environmentally friendly technologies, offers opportunities to reduce environmental degradation while improving resource efficiency and economic performance. However, Pakistan faces considerable barriers to adopting green innovations, including limited financial resources, inadequate infrastructure, technological dependence, skills shortages, and institutional constraints. This study examines the role of climate action and green innovation in promoting sustainable economic development in Pakistan, identifies major economic and institutional barriers to green technology adoption, and explores policy pathways for accelerating the country's green transition. The study employs a systematic literature review of secondary sources, including academic publications, government reports, and relevant policy documents addressing climate change, green innovation, sustainable development, and environmental economics. A thematic approach is used to analyze the economic implications, opportunities, implementation challenges, and policy mechanisms associated with climate action and green innovation. The review highlights the potential of renewable energy adoption, energy efficiency improvements, sustainable production, and efficient resource utilization to support economic development while reducing environmental pressures. Nevertheless, high investment costs, inadequate financing mechanisms, weak infrastructure, limited technical expertise, and implementation challenges continue to hinder progress. The study emphasizes the need for coordinated economic and environmental policies that encourage clean technology investment, strengthen institutional capacity, develop technical skills, and facilitate technology transfer. It concludes that integrating climate action with green innovation can help Pakistan achieve sustainable economic growth, generate employment opportunities, strengthen climate resilience, and advance its transition towards a low-carbon economy.

Keywords: Climate action, Green innovation, Sustainable economic development, Green finance, Environmental economics

From Crop Residue to Circular Chemistry: Regulator-Guided Bacterial Lignin Funneling as A Green Innovation Pathway

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Agricultural and agro-industrial activities generate vast quantities of lignocellulosic residues, including wheat straw, sugarcane bagasse, and cotton stalks. Much of this material is burned in the field or discarded, contributing to air pollution, greenhouse gas emissions, and the loss of a renewable carbon resource. Lignin, the most abundant renewable aromatic polymer in plant biomass, could be converted by bacteria into valuable products such as bioplastics (PHA), muconic acid for nylon precursors, and vanillin. However, its heterogeneous chemistry has limited efficient microbial conversion. This study reports a mechanistic framework for the transcriptional control of bacterial lignin funneling, organized around four dimensions: (i) the physiological signal molecule that a regulator senses, (ii) the position in the pathway where sensing occurs, (iii) the strength of experimental evidence, and (iv) the host's carbon context. Building on this framework, our proposed study summarizes engineering strategies, including matching transport with metabolic capacity, dynamic biosensor-controlled pathways, and host-specific genetic tools. We discuss how these principles could support regionally adapted biorefinery approaches that use local lignin streams, such as crop residues and paper-mill black liquor, to reduce open burning, lower dependence on petrochemical feedstocks, and create skilled green-biotechnology opportunities. The study also outlines priorities for building capacity, benchmarking regulatory parts with local feedstocks, developing genome-editing tools for native isolates, and embedding these topics in STEAM education and industry-academia partnerships. Together, these steps offer a practical roadmap for turning residue burdens into circular-economy value in support of climate action.

Keywords: Lignin valorization, Biomass waste, Green chemistry, Circular bioeconomy, Climate action

Synthesis and Characterization of Cerium Oxide/CNTs/PANI Ternary Hybrid as a High-Performance Supercapacitor Electrode Material

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Advanced energy storage devices with characteristics like quick charge-discharge capabilities, long-term cyclic stability and high-power density must be developed to meet global sustainable energy requirements. However, recent research has challenged the trade-off problem like batteries store high energy density but low power density while the conventional capacitors store high power density but low energy density by making supercapacitors. A facile hydrothermal method is used to prepare this ternary composite by taking ammonium persulfate which was used as the oxidant in the in situ chemical oxidative polymerization of aniline monomer in an acidic solution. Raman spectroscopy XRD and FTIR, GCD, CV and EIS were used for the characterization of synthesized material. EIS analysis revealed a steep low-frequency tail and a tiny high-frequency semicircle, suggesting effective charge transfer kinetics and quick ion diffusion. GCD results at 6, 12 and 18mA/s exhibited nonlinear behavior due to both capacitive and Faradaic charge-storage mechanisms related to PANI and CeO_2, and electric-double-layer capacitance from CNT. As a result, this hybrid composite provides strong reversibility, optimal rate capacity, and effective charge storage mechanisms which make it a very promising option for high-power energy storage systems for the future.

Keywords: Supercapacitor, Cerium oxide, Carbon nanotubes, Polyaniline, Ternary hybrid composite

The Role of Smart Infrastructure in Promoting Sustainable Urbanization and Environmental Resilience in Pakistan: An Economic Perspective

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Rapid urbanization in Pakistan is placing growing pressure on transport, communication, energy systems, and environmental resources, increasing the need for infrastructure that supports development while improving resource efficiency. This study examines the relationship between smart infrastructure, proxied by paved roads, renewable electricity generation, and fixed telephone subscriptions, and sustainable urban outcomes in Pakistan. Annual data for 1990–2023 are analyzed using five separate Autoregressive Distributed Lag (ARDL) models for urban GDP, urban literacy, energy-use intensity, CO_2 emissions per capita, and PM2.5 exposure. Augmented Dickey-Fuller tests confirm that no variable is integrated of order two, and bounds tests indicate long-run relationships in all models. The results are heterogeneous. Paved roads are positively associated with urban GDP (marginally) and literacy, and negatively with energy-use intensity, but positively with CO_2 emissions. Renewable electricity is negatively associated with both energy-use intensity and urban literacy. Fixed telephone subscriptions are positively associated with literacy and energy-use intensity, and negatively with CO_2 emissions and PM2.5 exposure. Smart infrastructure therefore does not relate uniformly to sustainable urban outcomes, supporting coordinated infrastructure, energy-efficiency, and environmental policies rather than isolated infrastructure expansion. The estimates represent associations, not causal effects.

Keywords: Smart infrastructure, Sustainable urbanization, ARDL, Energy efficiency, Environmental resilience

Nature-Based Removal of Bispyribac-Sodium Using Floating Treatment Wetlands Intensified with a Biochar-Immobilized Bacterial Consortium

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Bispyribac-sodium (BIS), a widely used rice herbicide, is highly water-soluble, enters surface waters through agricultural runoff, and has been linked to sub-lethal toxicity in non-target aquatic animals, creating a need for low-cost, nature-based treatment. This study developed an intensified floating treatment wetland (FTW) system for BIS removal by coupling *Phragmites australis* with a bacterial consortium (CB2H) and *P. australis*-derived biochar (PABCCB2H was immobilized on PABC, and the immobilization was supported by zeta potential, infrared spectroscopy (FTIR), X-ray diffraction (XRD) and transmission electron microscopy (TEM) analyses. FTW pots containing tap water spiked with 10 mg L^{-1} BIS were monitored for 30 days in triplicate under six treatments: an unplanted control, a planted treatment (*P. australis*) alone, and four planted treatments intensified with CB2H (1% v/v), PABC (1.5% w/v), PABC-immobilized CB2H, or nutrients (NPK). Residual BIS was quantified by high-performance liquid chromatography (HPLC) on day 0, 10, 20 and 30. BIS removal followed the order: planted treatments intensified with PABC-immobilized CB2H (78%) > CB2H (73%) > PABC (59%) > nutrients (35%) > planted alone (32%) > unplanted control (26%). Degradation followed pseudo-first-order kinetics, with half-lives of 13.6 days for PABC-immobilized CB2H treatment and 65.6 days for the control. The best-performing treatment also reduced chemical oxygen demand (COD) by 64%, lowered biochemical oxygen demand (BOD), total organic carbon (TOC), electrical conductivity (EC) and total dissolved solids (TDS), kept pH within permissible limits, and improved seedling vigor in a phytotoxicity bioassay. The inoculated bacteria persisted in water, roots and shoots of *P. australis*. These results show that biochar-immobilized consortium intensified FTWs are a promising nature-based approach for treating herbicide-contaminated water, a step toward safe water reuse and Sustainable Development Goal 6 (Clean Water and Sanitation).

Keywords: Nature-based solutions, Floating treatment wetlands, Bispyribac-sodium, Water treatment, Biochar-immobilized bacterial consortium

Green Fabrication of $NiFe_2O_4$@rGO Nanocomposites for Efficient Electrochemical Energy Storage

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To meet the demands for sustainable and eco-friendly energy sources, researchers are focusing on the green synthesis of novel nanomaterials for energy storage. In the present study, nickel ferrite nanoparticles (NiF-NPs) were synthesized from the *Fagonia arabica* plant extract, followed by the formation of nickel ferrite nanocomposites with rGO (NiF-NCs). Structural characterization was performed by XRD, FTIR spectroscopy, SEM and EDX techniques. The electroanalytical tools, namely, CV, GCD and EIS, were employed to investigate the electrochemical properties of green-synthesized nanomaterials. NiF-NCs demonstrated improved electrochemical performance as compared to NiF-NPs. NiF-NCs exhibited a superior specific capacity (Qs) of 136.8 C g^{-1} at a current density of 1 A g^{-1}. Dunn's graph showed diffusive and capacitive-controlled current contributions. To analyze the practical applications of NiF-NCs, they were used against an activated carbon (AC) electrode in an asymmetric supercapacitor device, where they delivered a remarkable Qs of 100.6 C g^{-1} at 0.5 A g^{-1}. The determined value of specific energy (Es) was 20.6 Wh kg^{-1}, and the specific power (Ps) was 835.9 W kg^{-1}. A coulombic efficiency of 99% and a capacitance retention 40% were recorded after running 10 000 GCD cycles. The excellent electrochemical properties and cycling stability reported in this work highlight NiF-NCs as an attractive and efficient nanomaterial for future energy storage technologies.

Keywords: Green synthesis, Energy storage, Electrochemical properties, Efficient nanoparticles, Cyclic stability

Climate-Driven Nutrient Erosion: The Emerging Micronutrient Crisis in Pakistani Diets

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Climate change significantly affects the security of nutritious food not just because of decreased crop yields but also by compromised food quality. Elevated atmospheric CO_2 accelerates plant growth while systematically depressing essential micronutrients particularly zinc and iron. Because of this a significant phenomenon increasing agricultural biomass which directly removes the density of nutrients of staple crops globally. This helps to analyze how the carbon dioxide driven nutrient decreases in wheat and rice, impacts micronutrient sufficiency in Pakistan. From analyzing different researches, different alterations in zinc and iron concentrations are observed under increased carbon dioxide environments and locally adapt these changes against Pakistan's baseline nutritional deficiencies. A detailed analysis of research in which almost 135 different studies and about total 542 observations describe a systemic decline for about 3 to 12% in crop micronutrients under increased carbon dioxide. Particularly the analysis of grains reveals that wheat suffers almost 9% reduction in zinc and more than 4 % loss in iron while rice exhibits parallel drops for more than 3% and 5.4%. These data consider critical implications for Pakistan. Nutrient dilution constitutes which are driven by climate creates an underlying reason of food insecurity. Important climate adaptation actions should enhance more than just increased production of crop yields to significantly protect nutritional quality. Limiting these upcoming nutritional risks needs a multiple intervention strategy. Implementation of nutrient focused crop breeding, scaling of zinc and bio fortification of iron along with optimized management of soil nutrients and promoting dietary diversity. Enhancing the nutritional quality further into climate resilient agriculture and framework of food security is significantly practical to prevent climate change from increasing Pakistan's baseline micronutrient deficiencies.

Keywords: Climate change, Nutrient erosion, Micronutrient security, Pakistani diets

The Gut-Lung Axis in *Mycoplasma gallisepticum* Infection: A Sustainable, Antibiotic-Sparing Framework for Poultry Health

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Mycoplasma gallisepticum (MG) is an important respiratory pathogen of poultry with a global pooled prevalence of 27.0% (95% CI: 20.4–34.2%) which is considerably higher in breeder and layer flocks. The increasing trend of antimicrobial resistance (AMR) is negatively impacting traditional control methods using antibiotics and creating the need for environmentally friendly alternatives. This study synthesized literature from both poultry and mammalian species and in *in-vitro* studies to explore the bidirectional communication between intestinal microorganisms, their metabolites (such as SCFAs and tryptophan metabolites) and respiratory immunity, which is known as the gut-lung axis. It places this axis as a key to antibiotic-free management of the MG. This study also uses a three-tier evidence structure to differentiate between direct evidence from chickens with MG, indirect evidence from other respiratory models in chickens, and mechanisms inferred from other gut-lung axis work in mammals. Thus, it is indicating where mechanisms are solidly established for chicken and are extrapolates from mammalian work. It also differentiates between the dysbiosis caused by MG and the dysbiosis caused by antibiotics, two different but often confused pathways. This study builds upon this foundation and examines five strategies to reduce reliance on antibiotics: probiotics, prebiotics, postbiotics/synbiotics, phytobiotics, and bacteriophages. It also highlights their ability to regulate the balance of cytokines, stimulate the production of antimicrobial peptides and function as vaccine adjuvants. Results suggest that host-resilience interventions may help reduce the dependence on antimicrobials, reduce AMR selection pressure, and alleviate the environmental burden of antimicrobials from intensive poultry farming. This study provides a systems-biology pathway to more sustainable approaches to poultry health, one that focuses on modulation of the microbiome rather than targeting pathogens, to protect food security and public health in a green way. Standardized, MG-specific studies are suggested for field validation.

Keywords: Gut-lung axis, *Mycoplasma gallisepticum*, Antibiotic-sparing strategies, Sustainable poultry production, Microbiome modulation

The Climate Nutrition Nexus: Rethinking Food Choices for People and Planet

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Climate change and nutrition are increasingly acknowledged as interconnected linked challenges. Food systems influence environmental sustainability while climate related interruptions threaten food security, dietary diversity and nutritional well-being. This study aimed to analyze the relationship between dietary choices, nutritional health and environmental sustainability and to recognize food patterns that may benefit both people and the planet. Data was collected from PubMed, Scopus and Google Scholar using combinations of keywords including climate change, nutrition, sustainable diets, food choices greenhouse gas emissions, planetary health and food systems. Studies were included if they examined the nutritional, health or environmental consequences of dietary patterns and food choices. Articles unrelated to dietary behavior or nutritional outcomes were omitted. Relevant literature was reviewed according to predefined eligibility criteria, and findings were thematically summarized to compare dietary patterns based on nutritional adequacy, health outcomes, resource use and environmental impact. The evidence demonstrated that diets prioritizing plant-based foods, legumes, whole grains, fruits, vegetables and minimally processed foods generally provide beneficial health outcomes while generating lower environmental impacts. In contrast, high consumption of red and processed meats and other resource intensive foods is associated with greater greenhouse gas emissions and environmental burdens. However, sustainable dietary shifts must account for nutritional requirements, affordability, cultural preferences, food accessibility and local food systems. Integrating climate considerations into nutrition recommendations can contribute to healthier and more sustainable food systems. A climate sensitive approach to dietary guidance supported by healthcare professionals, policymakers, consumers and food sector interested parties are vital for promoting dietary choices that protect human health while reducing environmental pressures.

Keywords: Climate, Nutrition, Food security, Dietary choices, Healthy diets, Diet and cultures

Eco-Worry and Eating: The Influence of Climate Anxiety on Sustainable Food Decisions Among Generation Z

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Continuous changes in climate have costed mental health of young individuals and resulted in increased incidences of eating disorders. It is critical to consider the effects of climate change challenges on psychological health of Generation Z. This review aims to focus on how climate anxiety has influenced the food choices among young adults. A structured literature review was conducted among different databases, including Google Scholar, PubMed, Scopus and Web of Science. Search strategy included keywords like, “climate anxiety”, “sustainable eating”, “sustainable food decisions” and “climate change”. Publications that described the link between climate change and eating patterns, and were published in period of 2016-2026 were considered eligible. Initially, a total 51 articles were identified and evaluated. Editorials and duplicates were removed from analysis, 24 publications were excluded. Final synthesis included 27 publications including systematic, narrative papers. Generation Z has gone through severe climate anxiety, which has influenced them to opt for sustainable food choices. It has played a motivational role. However, this relationship is neither linear nor uniformly beneficial. Sustainable food choices, as a result of environmental factors have become complicated, and there is a need for psychological, social and cultural assistance. Eco-worry is a two sided psychological construct, it helps people to opt for better and informed food choices, but excessive anxiety results in stressful eating behaviors. Interventions should be designed and adopted to lower the climate induced psychological stress. The results underscore the importance of interdisciplinary collaboration among nutritionists, policy makers and psychologists to help Generation Z adopt sustainable eating habits without the emotional discomfort. Furthermore, future research should identify the point of differentiation at which climate anxiety shifts from motivating to debilitating.

Keywords: Climate anxiety, Sustainable dietary behaviors, Generation Z, Sustainable eating patterns

Food By-Products to Microbiome Modulator: A New Frontier in Sustainable Personalized Nutrition

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Food by-products obtained during the processing of foods such as peels, seeds, pomace, bran and husk of fruits, vegetables, cereals have become an essential source of dietary fibers, pectin, polyphenols, resistant starches, oligosaccharides and bioactive peptides due to the shift from food waste to nutrients for gut microbiota. The nutrients can affect the gut microbiota as they can participate in the fermentation process and metabolite production, particularly short-chain fatty acids (SCFAs). Since everyone has varying levels of fermentation abilities, by-products could cause different effects to different people, thus making the valorization process related to reducing waste and sustainable food systems. PubMed, Scopus, and Web of Science from 2019 to 2026 were systematically searched using keywords that include food by-products, bioactive components, gut microbiota, microbial metabolites, personalized nutrition and sustainable nutrition. The search results were then filtered based on predetermined eligibility criteria. Duplicates were excluded. Title and abstract screenings followed by full-text evaluations resulted in 66 relevant articles included in the qualitative synthesis. This study reveals a conceptual evolution from food waste to bioactive compound, to gut microbiota modulation, to production of metabolites and further to physiological effects of the host to eventually individualized microbiome specific effects. Food processing causes structural modifications in fiber, which have an effect on the bioavailability of bio-actives and thus on production of SCFAs (acetate, propionate, butyrate). Inter-individual variability in polyphenol metabolism due to genetic and microbiome differences indicates that individualized metabolic evaluation is necessary to take advantage of their beneficial effects. This paradigm is consistent with the United Nation's Sustainable Development Goal (SDG) for good health and well-being (SDG3), responsible consumption and production (SDG12), and climate action (SDG13), through nutrition aimed at the microbiome as well as sustainable product and climate aware resource utilization.

Keywords: Food by-products, Dietary fibers, Polyphenols, Gut microbiome, Personalized nutrition

Sustainable Eating: Leveraging Plant-Based Diets for Human and Ecological Wellbeing

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Sustainable eating is gaining attention because of growing concerns about human health and the environment. Poor dietary habits can increase the risk of chronic diseases, while certain food production practices strain natural resources. This study focuses on the role of plant-based foods in developing healthier and more environmentally friendly eating habits. Foods such as fruits, vegetables, pulses, whole grains, nuts, and seeds contain important nutrients, fiber, antioxidants, and other beneficial compounds that support good health. Regularly including these foods in the diet may help lower the risk of conditions such as cardiovascular disease, obesity, and other diet-related health problems. Plant-based foods may also have a lower environmental impact and can help reduce land and water use and the emissions associated with food production. However, following a more plant-based diet may not always be easy. Food prices, availability, cultural traditions, nutrition needs, and awareness all shape what people eat. Nutrition education and easier access to affordable, locally grown plant foods can help people make healthier, more sustainable choices. A balanced diet does not have to exclude animal products; it can include a wider range of nutritious plant foods alongside them. Choosing plant foods more often can benefit health and reduce the environmental impact of eating. With greater awareness and practical support from communities and nutrition professionals, sustainable eating can become an achievable part of everyday life.

Keywords: Sustainable eating, Plant-based diets, Sustainable nutrition, Human health, Environmental sustainability

Green Innovation and Food Wastage Reduction: Pathways towards Sustainable Food System

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Food wastage has emerged as a major key concern for the long-term viability of modern food production networks because food not being consumed not only signifies depletion of edible food resources but also contribute to wastage of natural resources like and other resources invested committed through the food supply chain. The rising value of food wastage also leads to atmospheric greenhouse gas emissions, environmental damage, economic burdens and threats linked to food security. Sustainable innovation creates a possibility to tackle this challenge by merging mitigating strategies, refine production processes and preservation systems, digital solutions and advancements, resource efficient packaging, redistribution of surplus foods and circularity and economy-based approaches. This systematic review investigates the influence of green innovation in minimizing food waste and estimates how technology driven, behavior related, structural and government interventions can help achieve a more resilient food system. Existing literature carefully revealed through searches of Google Scholar and major scientific databases using various search terms linked to food wastage, loss of food, sustainability-oriented innovation, regenerative economy, equitable food systems and food waste valorization. Eligible studies were considered in terms of their significance to food wastage prevention, technological advancement, resource reclamation, redistribution of foods and other feasible management practices. The available findings were collected to evaluate their influence in reduction of food waste and development of sustainable food networks. However, technology-based interventions alone may not adequately address the problem. Consumer behavior, infrastructure, economic incentives, policy support and stakeholder collaboration strongly influence implementation. An integrated approach combining green innovation with prevention, circularity and behavioral change is therefore required to achieve long term reductions in food wastage.

Keywords: Food waste, Green innovation, Sustainable food systems, Circular economy, Food up cycling.

Green Innovation and Renewable Energy as Drivers of Climate Action: Evidence from Emerging and Developing Economies

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Climate change is a major policy challenge for emerging and developing economies, as economic growth is often linked with increased energy consumption and environmental stress. Although renewable energy and green innovation are viewed as complementary technologies for low-carbon development, the role of green innovation in enhancing environmental impacts of renewable energy remains unclear in these economies. This study examines how use of renewable energy and green innovation affect CO_2 emissions in emerging and developing economies. CO_2 emissions are used as environmental performance indicator, with explanatory indicators including renewable energy usage and green innovation. The control variables include economic growth, industrialization, trade openness, and urbanization. The analysis examines how green innovation affects the effectiveness of renewable energy in lowering CO_2 emissions. Data will be acquired from existing datasets, mostly from the World Bank and OECD, and analyzed using panel econometric methods that consider cross-sectional dependence, slope heterogeneity, and statistical properties. The study, which combines energy transition and technology innovation in a single empirical framework, aims to provide empirical evidence on how emerging and developing nations can improve the effectiveness of their climate efforts while supporting long-term economic change. The findings will help policymakers build innovative renewable energy policies and create sustainable, future-ready economies.

Keywords: Green innovation, Renewable energy, Climate action, CO_2 emissions, Environmental sustainability.

Beyond Production: Using Circular Food Systems to Deliver Healthier Diets

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Food systems are under increasing pressure to reduce environmental impacts while ensuring access to safe, nutritious and affordable diets. Circular food systems seek to reduce food loss and waste, retain valuable nutrients and biological resources, and make better use of food throughout the supply chain. However, greater resource efficiency does not automatically result in healthier diets. The nutritional and public-health implications of circularity depend on the type of resource retained, the pathway through which it is reused or recirculated, and whether nutritional quality, food safety, affordability and accessibility are considered. A structured search of PubMed, Scopus, Web of Science and Google Scholar identified 680 records, of which 503 studies examining circular food systems and their nutritional, environmental, health and equity implications were included. Some of these innovations may help preserve or increase the availability of nutritious foods, whereas others may primarily serve environmental or economic purposes. In certain instances, trade-offs could occur since recovered materials may need further processing or could pose health hazards or even produce food that may be out of reach for those less fortunate individuals. Circular food systems should always take into consideration the issue of equity and wellbeing. A broader basis for evaluating circularity is needed if it is to contribute meaningfully to healthier diets. Environmental performance should be considered alongside diet quality, climate resilience, food safety, affordability, accessibility and the practical conditions required for implementation. Considering these factors together can help identify whether circular interventions provide wider benefits or simply transfer environmental or social challenges elsewhere. Circular food systems may therefore contribute to sustainability, equity and population health when nutritional and social objectives are incorporated into their design rather than treated as secondary outcomes.

Keywords: Circular food systems, Healthy diets, Climate sustainability, Equity, Public health

Beyond Sustainability: Reimagining Future Nutrition through Climate-Resilient Food Systems

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Climate change indicates particular challenges to the ability of the world to accommodate adequate food access and nutritional requirements. Elevated temperature, hot weather extremes, and water shortages shows significant impact on agriculture, resulting major consequences in declining crop production and animal productivity. The increasing reliance of global food system on a few species may negatively impact on food and nutritional security. Biodiversity enhancement which includes native biological species is mainly a feasible option to identify the problem. However, limited evidence has been synthesized regarding how the combined application of crop diversification and climate-smart agricultural practices can simultaneously address food security, dietary diversity, and nutritional quality under changing climate conditions. Therefore, this review aimed to examine the potential of climate-resilient food systems to improve food and nutrition security by evaluating the roles of crop diversity, biodiversity conservation, and climate-smart agricultural practices. A literature-based review was conducted by examining published research on climate change, agricultural productivity, crop diversification, climate-smart agriculture, food security, dietary diversity, and nutrition, and the findings were thematically synthesized to identify key challenges, opportunities, and potential trade-offs. There may be a tradeoff between struggles to enhance production of food by implementing CSA practices and the subsequent dangers of decreased food and nutrition security. The reviewed evidence indicates that crop diversification and climate-smart practices can enhance agricultural resilience, improve food availability, and support dietary diversity. However, their nutritional benefits depend on their integration with nutrition-sensitive approaches, local food systems, and equitable access to resources. An approach that reflects climate resilience along with crop diversity and nutritional quality of crops can help build food systems capable of providing sustainable and nutritious diets for future generations.

Keywords: Climate change, climate-resilient food systems, food security, crop diversification, dietary diversity

Next Generation Edu-Tech and Ethics: Guiding Principles for Future Generations

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Next generation educational technology is rapidly and fundamentally reshaping learning landscape and academic ecosystem landscapes through immersive virtual tools, smart adaptive platforms and automated assessment frameworks. Ensuring that these unprecedented technological advancements serve future generations responsibly requires an aligned and robust ethical compass alongside continuous technological progress. Despite the exceptionally swift adoption of advanced digital tools in modern classrooms, critical and significant gaps persist regarding student data protection, digital equity and the appropriate ethical boundaries of automated education systems. This study employs a descriptive qualitative analysis, rigorously examining emerging Edu-Tech Policies alongside current digital ethics frameworks across modern learning environments. Empirical Findings indicate that next generation tools substantially enhance learner engagement and administrative efficiency overall. However, without proactive guidelines and strategic oversight, they introduce severe sensitive risks, including algorithmic discrimination, commercial exploitation of student sensitive data and a dangerous degradation of diminished human agency in critical pedagogical decisions. To build resilient and sustainable educational ecosystems moving forward, institutions must establish foundational ethical principles centered on transparent algorithms, robust and enforceable data governance, equitable digital access for underserved populations and human-led instruction supported by continuous professional development.

Keywords: Artificial intelligence education, Adaptive learning systems, Automated assessment

Air Pollution and Respiratory Health in Faisalabad, Pakistan: A Systematic Review of Health and Economic Evidence

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Rapid urbanization and industrialization have intensified air pollution as an environmental and public health concern, particularly in rapidly developing cities. Faisalabad, one of Pakistan's major industrial and textile manufacturing centers, is exposed to particulate matter and other pollutants from industrial activities, textile manufacturing, vehicular emissions, and seasonal biomass and crop-residue burning. However, evidence integrating the respiratory health and economic consequences of air pollution in Faisalabad remains limited. This systematic review synthesizes available evidence on air-pollution exposure, respiratory health outcomes, and associated economic consequences in Faisalabad, while drawing on evidence from Pakistan and comparable developing economies to identify major evidence gaps. The review followed the PRISMA 2020 framework and PECO approach. A systematic search of major academic databases and repositories, including ScienceDirect/Elsevier, PubMed, Springer, MDPI, Frontiers, PLOS One, Google Scholar, and other scholarly sources, was conducted for studies published between 2015 and 2026. Evidence was examined for particulate matter ($PM_{2.5}$ and PM_{10}), industrial and occupational pollution, biomass and crop-residue burning, and respiratory outcomes including asthma, bronchitis, chronic obstructive pulmonary disease, respiratory infections, hospital admissions, and mortality. The evidence indicates that air pollution in Faisalabad frequently exceeds recommended air-quality standards, with industrial and textile activities, vehicle emissions, and seasonal burning identified as important sources. Although economic evidence indicates substantial healthcare, welfare, and productivity losses, formal integrated economic valuation in Faisalabad remains limited. Strengthening air-quality monitoring, emission controls, cleaner production technologies, and integrated health-economic research is essential for supporting sustainable and healthier cities.

Keywords: Air pollution, $PM_{2.5}$, PM_{10}, Respiratory health, Economic burden

From Toxic to Safe: A Nature-Based Multi-Stage Treatment Train for Textile Effluent Reuse

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Textile industrial effluents pose severe ecotoxicological risks due to high organic loads, dyes, and recalcitrant pollutants. Conventional treatment systems are often energy-intensive and cost-prohibitive, underscoring the urgent need for sustainable, nature-based remediation strategies. This study demonstrates a multi-stage, nature-based treatment train deployed at an industrial scale at Interloop Limited, Faisalabad. The integrated system combined an Anaerobic Digester (AD, 2 days Hydraulic Retention Time-HRT), a Floating Treatment Wetland (FTW, 3 days HRT), and a Constructed Wetland (CW, 2 days HRT), both vegetated with pre-screened *Phragmites australis*. Field-scale operational data showed system scalability, robustness, and high decontamination performance, achieving 87.8% Chemical Oxygen Demand (COD) and 85.3% Biological Oxygen Demand (BOD) removal, mirroring pilot-scale efficiencies (86.8% COD, 84.3% BOD). The treatment train attenuated persistent macro-pollutants and nutrients, securing overall removals up to 78% Total Kjeldahl Nitrogen, 74% Phosphorus, 74% Sulfate (SO_4^{2-}), and 71% Total Dissolved Solids (TDS). Phytotoxicity testing using wheat (*Triticum aestivum* L.) seed bioassays demonstrated significant toxicity mitigation along the treatment train. Raw industrial effluent severely impaired crop growth, yielding a Seed Germination Index (SGI) of 4% and growth inhibition of 72%. Sequential passage through AD, FTW, and CW progressively restored the SGI to 82% and suppressed overall growth inhibition down to 16%. Specifically, root length inhibition decreased from 75% in raw effluent to 13% in the final CW discharge. These results confirm that the integrated nature-based system offers a highly effective, scalable, and sustainable green innovation capable of converting hazardous textile effluents into eco-friendly water suitable for agricultural reuse and environmental discharge.

Keywords: Textile wastewater, Floating treatment wetlands, Phytotoxicity, Water reuse

Climate Change and Psychological Trauma: A Psychoanalytic Perspective in *The Ministry for the Future* (2020)

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The purpose of this research is to examine the psychological trauma caused by the climate change in Kim Stanley Robinson's novel *The ministry for the future (2020)* through Sigmund Freud theory of psychoanalysis. The research focuses on Frank May, an American aid worker, the survivor of Indian devastating heatwave killing over 20 million people. The psychological effects of this climate disaster are examined through the role of repression in shaping Frank's response to his traumatic experience. The study uses qualitative textual analysis and purposive sampling, with selected passages and dialogues from the novel on the basis of their relevance with Frank's traumatic experiences, psychological responses and repression. Freud's theory of psychoanalysis is used as a theoretical framework for analyzing the selected textual passages and dialogues. The finding shows that Frank's experience of the heatwave continues to affect his thoughts, emotions and behavior after the devastating event, revealing lasting effects of climate change not only an environmental crisis but also a source of psychological suffering. The study is significant in highlighting the relationship between climate catastrophe and human psychology and showing how psychological disturbance can explain the representation of trauma induced by climate in contemporary climate fiction.

Keywords: Psychological trauma, Climate catastrophe, Repression, Psychoanalysis, Contemporary climate fiction

Greenwashing Through Words: An Eco-Linguistic Analysis of Eco-Friendly Advertising in Rivaj Mahal Oil Campaigns

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This study discusses the greenwashing phenomenon and goes deeper into Eco linguistic analysis of eco-friendly advertising in Rivaj Mahal Oil. Businesses, particularly in the cosmetics and herbal fields, are turning to language that cares for the environment and nature to appeal to consumers who care about health and environmental sustainability. The term “pure” or “chemical-free” or “natural” or “organic” is often used to build up that image of an environment friendly product. Often, though, the assurance is not backed up by scientific data or by reliable ecological procedures. The study focuses on the creation of ecological meanings and perceptions in the Rivaj Mahal Oil advertisements, using an ecolinguistic framework as the approach. Lexical, framing strategies, emotional appeals and ideology patterns are analyzed in ten selected advertisements. The results indicate that environmental language is deployed strategically topocpeize the romanticization of nature and to foster consumer confidence, and at the same time consumer the commercial orientation of advertising messages. The study focuses on the way greenwashing acts on the level of language, in symbolic (ecological) representation, not in true environmental commitment.

Keywords: Greenwashing, Ecolinguistics, Eco-Friendly language, Rivaj Mahal Oil, Environmental communication

Sustainable Bio-Resource Utilization: Exploiting *Foeniculum vulgare* Bioactive Metabolites for Eco-Friendly Phyto-therapeutic Interventions in Neuromuscular Injury

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Plants produce bioactive compounds, also known as phytochemicals, which offer significant potential for eco-friendly therapeutic interventions against complex physiological disorders. *Foeniculum vulgare*, commonly known as fennel, belongs to the Apiaceae family. It is cultivated throughout the Eastern and Western hemispheres, including Europe and North America. It has well-documented pharmacological properties, including antimicrobial, analgesic, antipyretic, anti-inflammatory, antiseptic, and antioxidant effects. This study evaluates the bioefficacy of plant-derived metabolites from *F. vulgare* in promoting neuromuscular recovery following peripheral nerve injury, offering a sustainable Phyto therapeutic alternative to synthetic therapeutics. Furthermore, Male albino mice (n=16) were obtained from the animal house of the Department of Physiology, Government College University, Faisalabad, and divided into two cohorts: the control group (group 1) was given a normal chow diet, and the treatment group received a diet containing 500mg/kg/day of crude *F. vulgare* seeds after nerve lesion. Motor functional recovery, histological axonal regeneration, and serum oxidative stress markers were evaluated post-treatment. Statistical analysis demonstrated significant modulation of inflammatory markers. Furthermore, it improved the myofibril cross-sectional area and accelerated functional nerve recovery ($p < 0.05$) in the treated group compared to controls. Conclusively, these findings suggest that *F. vulgare* bioactive metabolites act as effective natural therapeutics for peripheral nerve repair, highlighting their application in green tissue engineering and neuromuscular regenerative medicine.

Keywords: Sciatic nerve, Phyto therapeutic, Tissue engineering, Neuromuscular recovery, Foeniculum vulgare

Entanglement, Intra-Action, and Assemblage: A Posthumanist Perspective on the Sustainable Development Goals

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This paper offers a posthumanist reading of the Sustainable Development Goals (SDGs), situated within the interdisciplinary domain of STEAM education, and interrogates the anthropocentric presuppositions that undergird dominant sustainability discourse. Grounded in posthumanism and its concomitant commitment to post anthropocentrism, the study advances a post-dualist critique of the human/nonhuman, subject/object, and nature/culture binaries that have historically structured sustainability thinking, reconceptualising sustainability as an emergent property of entangled human-nonhuman assemblages rather than an outcome unilaterally engineered by human actors upon an inert environment. Employing a qualitative methodology grounded in sustained textual and conceptual analysis, the paper takes the SDGs as its corpus, elucidating how intra-action, entanglement, and assemblage function as generative concepts for reimagining climate change adaptation and mitigation, ecological restoration, and biodiversity conservation as co-constitutive processes. Nonhuman agency—material, technological, and ecological—is foregrounded as a constitutive force in climate resilience and green innovation, decentring the human subject from its presumed position of exclusive dominion. The study further elucidates how STEAM education, conceived as a site of entangled human-technology-environment relations, may cultivate algorithmic literacy and sustain artificial intelligence in education as instruments of participatory governance and digital transformation in service of sustainable development. Attention is accorded to how a postanthropocentric pedagogy might advance accessibility, inclusion, equity, and diversity within STEAM curricula, while fostering entrepreneurship development, sustainable livelihoods, and workforce development attuned to ecological limits. The paper contends that research excellence in this domain necessitates sustained engagement with nonhuman materiality as intrinsic to sustainability, yielding implications for policy, pedagogy, and future scholarship at the intersection of posthumanism and sustainable development.

Keywords: Sustainable development goals, Posthumanism, STEAM education, Climate change, Climate action

Contextualizing the Planetary Health Diet for Pakistan: Reconciling the 2025 EAT-Lancet Framework with Local Food Realities

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The rising frequency of diet-related disorders, combined with environmental limits on food production, has positioned food systems at the center of two converging global crises. In response to both, the 2025 EAT-Lancet Commission's revised Planetary Health Diet (PHD) analyzes the impact of food on all nine planetary boundaries and refines global dietary standards for health, environmental sustainability, and, for the first time, justice. The study does not address whether Pakistan, which has a terrible twin burden of hunger and acute climate and water vulnerability, can successfully adopt this global paradigm. In order to compare areas of agreement and divergence, this assessment superimposes Pakistan's nutritional, agricultural, and climate data on top of the 2025 PHD framework. Over four-fifths of Pakistanis cannot afford a healthy lunch due to wheat monoculture, a diminishing Indus Basin, and an import-dependent legume sector. It also has a 40.2% national rate of childhood stunting and the highest expected prevalence of adult diabetes worldwide. There is, however, a possible synergy: the food group that the PHD promotes the most is legumes, which are also deeply ingrained in Pakistani cuisine and appropriate for a nation with limited water resources, offering a foundation for cultural change. In keeping with the Sustainable Development Goals of zero hunger, excellent health, and climate action, this study provides a contextualized "Pakistan Planetary Health Plate" based on biofortification, tiered dietary guidance, and financial policy change. Furthermore, it highlights the growing role of dietitians to translate global nutrition science into locally applicable recommendations and urges for multidisciplinary collaboration between nutritionists, legislators, and agricultural scientists to reconcile global research with local reality.

Keywords: Planetary health diet, EAT-Lancet, Pakistan, Sustainable

Transitional Shift of Nutritional Psychiatry from Dietary Patterns Towards Precision Nutrition

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Cognitive health is primarily influenced by complex interactions among diet, metabolic health, inflammation, genetics, and the gut-brain axis. Precision nutrition represents a shift from generalized dietary recommendations towards individualized interventions based on genetic, metabolic, microbial, and inflammatory variability. Dietary patterns indicate greater consistency in improving neuroendocrine behavior, particularly Mediterranean and MIND diets *etc.* Recent research indicates a negative correlation between anti-inflammatory dietary patterns and depressive symptoms. Micronutrient interventions are associated with downregulation of aggression, ADHD, and emotional dysregulation. Emerging nutrigenomics suggest that genetic variation can modulate signaling cascades, and microbiome composition may influence dietary responsiveness through inflammatory, metabolic, and neuroactive pathways. Phytochemicals, including monoterpenes, polyphenols, ginsenosides, anthocyanins, and bioactive polysaccharides, exert multitarget neuroprotective impacts by reducing neuroinflammation while enhancing synaptic plasticity and neurogenesis through coordinated modulation of Nrf2/ARE, NF-κB, NLRP3, MAPK, BDNF/CREB, and PI3K/Akt pathways. Integration of metagenomics, metabolomics, and AI may ultimately enable identification of biomarkers that predict individual responses to dietary interventions. Despite extensive mechanistic research, nutrigenomic, epigenetic, and microbiome evidence remains observational or preclinical. Biomarker-stratified randomized controlled trials in clinically diagnosed psychiatric populations remain scarce, limiting the ability to predict who will respond to specific dietary interventions. Green extraction for standardized phytochemical-based interventions and culturally adaptable precision-nutrition strategies are still under-explored. Precision nutrition has remarkable potential to transform nutritional psychiatry from population-based dietary advice toward biologically informed, individualized care. However, systematic trials integrating psychiatric outcomes with multi-omics biomarkers, standardized interventions, and culturally relevant dietary approaches are required before precision nutrition can be incorporated into clinical guidelines.

Keywords: Cognitive health, Precision nutrition, Green extraction, Artificial intelligence

INNOVATION, ENTREPRENEURSHIP AND INDUSTRY LINKAGES

ORAL PRESENTATIONS

Women's Leadership in Higher Education: A Qualitative Cross-Cultural Analysis

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Women remain underrepresented in leadership roles within higher education, despite growing global attention to gender equity. This paper examines how women leaders navigate structural, institutional, and cultural barriers in diverse higher education contexts. Using a qualitative research design, the study draws on in-depth, semi-structured interviews with women in senior academic and administrative positions, including deans, department chairs, and program directors. The analysis highlights three central themes shaping women's leadership trajectories. First, structural barriers such as gendered hierarchies, limited access to mentorship, and insufficient institutional support continue to impede advancement. Second, participants described resilience strategies, including building informal networks and leveraging cross-cultural competencies. Third, mentoring relationships, both formal and informal, emerged as crucial in providing guidance, legitimacy, and pathways for career progression. Cross-cultural comparisons revealed significant variation. In contexts where patriarchal traditions dominate, women leaders reported heightened scrutiny and resistance, relying more heavily on relational strategies to establish authority. By contrast, in more egalitarian environments, institutional reforms and gender-sensitive policies were perceived as key enablers of leadership development. These findings underscore the need to interpret women's leadership within specific socio-cultural frameworks rather than through a universal lens. This study contributes to scholarship on gender and leadership in higher education by foregrounding women lived experiences across cultures. It further offers practical implications for institutions, including the implementation of gender-sensitive policies, expanded mentorship programs, and organizational cultures that recognize diverse leadership styles.

Keywords: Women leaders, Higher education, Qualitative research, Cross-cultural competencies

Rethinking Educational Kitsch: Commercialization, Market Logic and Educational Quality

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Educational kitsch refers to elements, materials, or educational approaches perceived as overly simplistic, sentimental, or lacking in depth. In an educational context, kitsch may manifest in various forms, such as teaching materials, methods, or educational content prioritizing superficial appeal over substance. The tendency to turn online education into a marketable commodity without sufficient regard for educational quality may be considered kitsch. The main purpose of this study is to explore the commercialization of education as a kitschy phenomenon. We used an exploratory research approach, while the methodology is based on a qualitative review of the literature taken from multiple databases. The primary analytical tool was the kitsch experience theory. The study results show that not all aspects of commercialized education are kitschy and some degree of commercialization is necessary for the sustainability of educational institutions. However, a balance must be struck to ensure that the primary focus remains on providing high-quality education rather than catering to market trends or profit motives.

Keywords: Kitsch in education, Commercialization, Market logic, Online and traditional education

STEM Innovation: Experiential Learning for Young Learners

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The keynote will share the FaSTLab experience in transforming STEM education through hands on, accessible and experiential learning particularly through the development and implementation of STEM learning kits and module. The talk will highlight the initiative's activities, strategic partnerships, outreach programmes and achievements across rural, urban and international settings. Among the key impacts to be presented are the engagement of almost 1,500 participants through FaSTLab initiatives an increase in students engaged in STEM programmes from 3,000 in 2024 to 4,500 in 2025 (50% increase), and an improvement in student understanding from below 20% to approximately 90%. The initiative has also significantly reduced laboratory preparation time from approximately two days to 60 seconds and reduced teachers' workload by at least two hours per teacher through STEM trainers and ready-to-use learning resources. The innovation has generated tangible economic and institutional value generating RM67,340 (Ringgit Malaysia) through STEM kit sales and Science Camps by the end of 2025. The innovation has also obtained copyright protection.

Keywords: FaSTLab, STEM education, Learning kits

Innovating the Palm Oil Supply Chain: Strengthening Entrepreneurship and Industry Linkages for Sustainable Growth

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The palm oil industry plays a significant role in global agribusiness, employment, trade, and rural livelihoods; however, its supply chain faces persistent challenges related to sustainability, value addition, market access, traceability and environmental and social concerns. This study examines how entrepreneurship and stronger industry linkages can contribute to the innovation and sustainable transformation of the palm oil supply chain. It focuses on the role of entrepreneurial ventures, smallholder producers, processors, technology providers, financial institutions, government agencies and industry partners in creating more efficient, inclusive and resilient supply-chain systems. Particular attention is given to digital technologies, sustainable production practices, value-added processing, circular-economy approaches and stronger collaboration between academia and industry. The study proposes that entrepreneurial innovation can improve resource efficiency, reduce post-harvest losses, enhance traceability, create new market opportunities and strengthen the participation of small and medium-sized enterprises in the palm oil value chain. Stronger industry–academia linkages can further support knowledge transfer, skills development, research commercialization and evidence-based solutions to sustainability challenges. The study concludes that an integrated entrepreneurship and industry-linkage approach can help transform the palm oil supply chain from a predominantly commodity-oriented system into a more innovative, value-driven and sustainable ecosystem. Such transformation can contribute to economic growth while promoting environmental responsibility, social inclusion and long-term competitiveness across the palm oil industry.

Keywords: Palm oil, Innovating supply chain, Entrepreneurship and industry linkages, Sustainable growth

Innovation, Entrepreneurship and Industry Linkages: Shaping Future-Ready Talent, Businesses and Economies

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Innovation, entrepreneurship and industry linkages are increasingly critical in shaping future-ready talent, resilient businesses and competitive economies in an era defined by rapid technological advancement, digital transformation and changing workforce expectations. This keynote highlights the need to move beyond traditional approaches to education and business development by creating stronger connections between universities, industries, entrepreneurs and policymakers. Innovation provides the foundation for addressing emerging challenges and creating new value, while entrepreneurship transforms ideas and knowledge into practical solutions, enterprises and economic opportunities. At the same time, meaningful industry engagement ensures that talent development remains relevant to real-world needs by strengthening employability, practical competencies, problem-solving abilities and entrepreneurial mindsets. This keynote will explore how collaborative ecosystems can accelerate knowledge transfer, support business transformation, nurture innovation-driven enterprises and prepare graduates to respond confidently to increasingly complex and uncertain environments. Particular attention will be given to the importance of experiential learning, industry-based projects, digital and AI capabilities and university–industry collaboration in closing the gap between academic preparation and workplace expectations. Ultimately, building future-ready economies requires more than producing skilled graduates or innovative firms in isolation; it requires an integrated ecosystem where talent, knowledge, technology, entrepreneurship and industry continuously interact to generate sustainable value, inclusive growth, and long-term competitiveness.

Keywords: Innovation, Entrepreneurship, Industry linkages, Digital transformation, Entrepreneurial ecosystems

From Innovation to Impact: Strengthening Entrepreneurship–Industry Linkages for Sustainable Economic Development

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Entrepreneurship and strong industry linkages are increasingly recognized as important drivers of innovation, employment generation, competitiveness and sustainable economic development. However, a persistent gap between entrepreneurial initiatives, academic institutions and industry requirements often limits the successful transformation of innovative ideas into commercially viable products and services. This review paper examines the role of entrepreneurship–industry linkages in strengthening innovation ecosystems and promoting sustainable economic development. Drawing on existing national and international literature, the study reviews the mechanisms through which universities, startups, established firms, industry associations, incubators, accelerators, and government institutions can collaborate to facilitate knowledge transfer, technology commercialization, entrepreneurial learning, access to finance, market development and skill enhancement. The review particularly focuses on university–industry collaboration, entrepreneurship education, research and development partnerships, technology transfer, startup incubation, digital entrepreneurship and industry-oriented skill development. The literature indicates that effective linkages can improve entrepreneurial capabilities, enhance innovation outcomes, support the commercialization of research and create employment opportunities. At the same time, weak institutional coordination, limited access to finance, inadequate industry participation, skills mismatches, regulatory barriers and insufficient commercialization mechanisms remain significant challenges. The paper further highlights the importance of supportive policies, entrepreneurial ecosystems, digital technologies and stronger academia–industry partnerships in converting innovative ideas into sustainable economic and social impact. The review concludes by identifying research gaps and proposing future directions for strengthening entrepreneurship–industry collaboration, particularly in emerging economies. The findings provide useful insights for policymakers, universities, entrepreneurs, industry stakeholders and development institutions seeking to build more innovative, inclusive and sustainable entrepreneurial ecosystems.

Keywords: Entrepreneurship, University–Industry collaboration, Innovation, Entrepreneurial ecosystems, Sustainable economic development.

Swords and Handshakes: Military Innovation in Contemporary International Relations

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Military innovation is often studied as a source of rivalry, yet the same innovations have also produced treaties, alliances and shared rules. This study examines the dual effect, using the metaphor of "swords" (conflict) and "handshakes" (cooperation) to ask how states come to interpret new military technologies as threats or as opportunities for cooperation, how they generate cooperation and what determines which path an innovation follows. The study uses a qualitative comparative case design and analyses two innovations: nuclear weapons, an established case with well-documented outcomes and military drones and autonomous systems, an emerging case in which governance is still developing. Evidence is drawn from treaties, official documents, policy reports and scholarly literature. The analysis adopts a constructivist lens, arguing that threat is socially constructed: rival states interpret each other's military innovations as dangers and respond by arming themselves. When both sides face mutual vulnerability, shared fear can transform this perception and lead to cooperation. This study concludes that whether it leads to conflict or cooperation depends on how states interpret and socially construct it, not on the technology alone. The nuclear case shows that cooperation can follow intense competition once shared understandings emerge, such as recognizing mutual vulnerability and developing norms of non-proliferation and non-use, later formalised in international law. The drone case shows how rapid technological advancement can outpace the norms and institutions intended to give innovation a shared meaning and govern its use. The paper concludes that as military innovation and advancement accelerate in artificial intelligence, space and cyber capabilities, the central challenge for international relations is not only to keep pace with new technologies, but to shape, through shared norms and understandings, what these innovations come to mean for cooperation and conflict.

Keywords: Military innovation, International relations, Conflict, Cooperation, Arms control, Emerging technologies

Exploring the Factor Effecting Entrepreneurial Female Financial Independence and Household Decision Making Power in Faisalabad

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Financial stability of women in a society is very important. The study of socio-economic conditions of females in Faisalabad is very significant as this city is the third largest city of Pakistan. The role of women participation in entrepreneurial activities is increasing due to massive education and awareness. However, due to spatial mobility restrictions, no financial independence and the hindrances of society caused the limited role of women in commerce and economic activates to make formal employment and real journey of women empowerment. This study examines the factors that effects transitional potential of entrepreneurship of women financial independence and her decision-making power in a household unit. Therefore, this study surveyed 20 female entrepreneurs in Faisalabad who owns micro, small and medium enterprise. Data were collected through semi-structured, detailed interviews and arguments and analyzed by using thematic analysis framework of Braun and Clarke. Qualitative techniques were used to analyze the data. The results concluded the entrepreneurial activities of women in Faisalabad is majorly affected by personal, institutional, social and financial factors. The financial literacy, support of family and entrepreneurial skills and continuous training and access to finance and available market opportunities are key drivers. The financial constraints, socio-cultural norms and limited mobility are key major barriers in the household decision making for establishing entrepreneurship. However, it is concluded that the entrepreneurial income increases the financial independence and decision-making power of women. Overall, a progressive and supportive entrepreneurial environment and ecosystem is necessary for women empowerment and participation.

Keywords: Socio-cultural constraints, Financial independence, Household, Women entrepreneurship

Innovative Agribusiness Strategies and Market Linkages for Smallholder Farmer Profitability: Evidence from Moong Bean Value Chains in Punjab, Pakistan

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Smallholder farmers frequently face limited market access, weak bargaining power and inefficient marketing practices that constrain their ability to capture greater value from agricultural production. This study examines how innovative marketing and value chain strategies can enhance the profitability and market participation of smallholder moong bean farmers in Bhakkar district of Punjab, Pakistan. The study focuses on three practical interventions: sorting and grading of moong beans to improve product quality and marketability, selling produce in Faisalabad as a major wholesale market, and collective marketing to strengthen farmers' bargaining position and market connectivity. The findings show that farmers adopting the proposed value chain interventions achieved an average additional revenue of PKR 880 per 100-kg bag compared with farmers following traditional marketing practices. At the truck level, the interventions could generate more than PKR 95,000 in additional revenue per truck. These findings demonstrate that innovation in marketing practices, collective entrepreneurial action, and stronger linkages with wholesale markets can create significant economic value for smallholder producers. The study highlights the importance of developing farmer-oriented agribusiness models that connect producers with larger markets and enable them to participate more effectively in value creation and value capture. The findings have implications for policymakers, agribusiness firms, farmer organizations and market institutions seeking to strengthen entrepreneurship, improve industry and market linkages and promote inclusive agricultural value chain development in Pakistan.

Keywords: Agribusiness innovation, Entrepreneurship, Industry linkages, Smallholder farmers, Profitability

Unveiling the Dynamic Nexus of Entrepreneurial Spirit, Self-Efficacy and Education on Drive: Insights into the Role of Teaching Competence

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Entrepreneurship is crucial to fostering economic growth and driving innovation in entrepreneurial education. The importance of fostering an entrepreneurial mindset and competence continues to rise, as does the impact of educational practices on entrepreneurial outcomes. The study explores the relationship between entrepreneurial education, entrepreneurial spirit, self-efficacy, and entrepreneurial drive. To examine whether teaching competence and entrepreneurial teaching moderate the relationship among entrepreneurial spirit, entrepreneurial self-efficacy, entrepreneurial education, and student achievement. The study collected data from STEM students in Pakistan using a cross-sectional research approach and analyzed them using PLS-SEM structural equation modeling. The findings showed that entrepreneurial self-efficacy, entrepreneurial spirit, and entrepreneurial education significantly and positively affect entrepreneurial drive. Moreover, entrepreneurial teaching and entrepreneurial competence moderated the strengthened relationship between green entrepreneurial self-efficacy, entrepreneurial spirit, and entrepreneurial education and entrepreneurial drive. Effective entrepreneurial educators nurture an entrepreneurial mindset in students, helping them develop the skills and competencies needed to succeed in entrepreneurship. This study provides guidance for creating impactful educational programs. The theoretical and practice-focused pedagogies serve as a fundamental framework for this investigation.

Keywords: Entrepreneurial drive, Entrepreneurship teaching, Entrepreneurship competence, Entrepreneurial self-efficacy, Entrepreneurial education, Entrepreneurial spirit

Innovation in Climate-Smart Agriculture for Sustainable Food Systems: A Narrative Review

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Climate change and food and nutritional insecurity are two global challenges of great concern. Although agricultural productivity has improved greatly over the past few decades, changing climatic conditions are creating new risks for sustainable food systems. Currently, the global food system is responsible for one-third of all greenhouse gas emissions. On the other hand, global food demand is predicted to increase because of rapid population growth, which is estimated to reach 9.7 billion by 2050. Conventionally, food production has increased through agricultural expansion and the unsustainable use of natural resources. However, increasing food demand and environmental pressures highlight the need for approaches that can increase productivity while improving resilience and resource-use efficiency. In this context, innovation in climate-smart agriculture (CSA) can not only enhance resource productivity and environmental performance but can also provide a pathway to ensure food and nutrition security for future generations. CSA comprises a range of practices and technologies that are specific to agro-ecological conditions and socio-economic contexts, including the adoption of climate-resilient crop varieties, conservation agricultural practices, agroforestry, precision agriculture, water management strategies and improved livestock management. This narrative review examines how innovation in climate-smart agriculture (CSA) can contribute to developing a more sustainable food system. It also discusses its significance across different stages of agricultural production and identifies the factors influencing the adoption and diffusion of CSA innovations among farmers and other food system actors. Particular attention should be given to the institutional, economic and social factors that influence the uptake of CSA practices and technologies. Finally, this review suggests that achieving sustainable food systems depends not only on the availability of innovative technologies but also on their effective adaptation, equitable accessibility and implementation within diverse local contexts.

Keywords: Climate-smart agriculture, Innovation, Sustainable food system, Food and nutrition security

From Entrepreneurial Experience to Performance: The Mediating Role of Entrepreneurial Competencies and Moderating Role of Entrepreneurial Learning

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Entrepreneurs play a vital role in China's economic development by fostering innovation, creating employment and stimulating regional growth. This study examines how entrepreneurial experience influences entrepreneurial performance through the roles of entrepreneurial competencies and entrepreneurial learning in Yunnan, China. Using two-stage survey data, the study investigates how entrepreneurs' prior experience shapes their competencies and subsequent performance. In the first stage, the authors conducted mediation and moderation analyses to examine the relationships among entrepreneurial experience, learning modes, competencies and entrepreneurial performance. In the second stage, the study further assessed the effects of entrepreneurial competencies on entrepreneurial learning and performance. The findings reveal that entrepreneurial competencies mediate the relationship between entrepreneurial experience and entrepreneurial performance, while entrepreneurial learning moderates the relationship between entrepreneurial experience and competencies. Moreover, the effects of entrepreneurial experience on performance are nonlinear and vary by experience type, learning mode and competence. The study identified six dimensions of entrepreneurial competence, with opportunity competence and relationship competence showing the strongest influence on entrepreneurial performance. The empirical findings further indicate that entrepreneurial competencies fully mediate the relationship between entrepreneurial experience and performance. Overall, this study extends the entrepreneurship literature by clarifying how experience is converted into improved entrepreneurial performance through competency development and learning processes. The findings also provide practical implications for entrepreneurs and policymakers seeking to strengthen entrepreneurial capabilities and enhance the likelihood of entrepreneurial success.

Keywords: Entrepreneurial experience, Performance, Entrepreneurial competencies, Entrepreneurial learning

Digital and Social Innovation for Community Resilience in Post-Conflict Communities: A Culturally Embedded Entrepreneurship Perspective

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This study examines how culturally embedded social entrepreneurship can contribute to community resilience in post-conflict and underserved communities, with particular attention to the role of social and digital innovation in adapting entrepreneurial solutions to local institutional and cultural conditions. The study draws on a quantitative cross-sectional investigation of 100 respondents from three Pakistani social enterprises and examines the relationships among human capital, social capital, motivational factors, cross-sector collaboration, cultural impact, corporate social responsibility policies and social business entrepreneurship success using correlation and regression analysis. The empirical analysis supported six of seven proposed hypotheses and identified significant positive relationships between social business entrepreneurship success and human capital, social capital, motivational factors, cross-sector collaboration, cultural impact, and CSR policies. These findings indicate that entrepreneurship outcomes in underserved settings are shaped not only by economic or organizational factors but also by social relationships, cultural context, stakeholder collaboration and responsible institutional practices. Building on these findings, the study develops a culturally embedded perspective for understanding how social and digital innovation can be adapted to strengthen community resilience in post-conflict environments. The study concludes that locally grounded entrepreneurship, supported by collaboration, cultural alignment, responsible practices, and appropriate innovation, offers a useful pathway for sustainable community development. The proposed perspective provides a basis for further empirical research on digitally enabled social entrepreneurship in post-conflict communities.

Keywords: Social entrepreneurship, Social innovation, Digital innovation, Community resilience, Post-conflict communities

Safeguarding Agricultural Land Amid Urban Expansion: Innovation, Entrepreneurship and Sustainable Industry Linkages for Food Security in Pakistan

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Rapid urbanization in Pakistan is accelerating the conversion of productive agricultural land into housing schemes and commercial developments, creating challenges for food security, rural livelihoods and sustainable development. This study examines the socioeconomic drivers and consequences of farmland conversion in peri-urban Faisalabad, highlighting opportunities for innovative land governance and more sustainable linkages between agriculture, entrepreneurship and urban industries. The analysis draws on a household survey of 120 respondents from four peri-urban villages in Faisalabad District, complemented by an updated review of international evidence on agricultural land conversion. Findings indicate that financial distress, rather than planned investment, was the primary driver of land sales, with most sellers subsequently expressing regret. Awareness of land-use regulations and the long-term consequences of farmland conversion was limited. Respondents also reported declining food adequacy, dietary quality and the sustainability of local water and agricultural systems following land conversion. These findings underscore the need to align urban development and commercial investment with agricultural sustainability. The study highlights the potential of innovative land-use planning, responsible real estate entrepreneurship and stronger institutional linkages among agricultural stakeholders, businesses and urban development authorities to protect productive farmland while supporting inclusive economic growth. It recommends a legally binding agricultural zoning framework, mandatory food-security impact assessments and strengthened land governance mechanisms. Integrating these measures into urban and industrial development strategies can help foster responsible entrepreneurship, safeguard agricultural resources and promote resilient agri-food systems.

Keywords: Agricultural land conversion, Urbanization, food security, Land governance, responsible entrepreneurship, Sustainable development

Developing a Sustainable AI Entrepreneurial Ecosystem: The Roles of AI Capability, Entrepreneurial Competencies and Innovation Support in Enhancing Entrepreneurial Success

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Artificial Intelligence (AI) is transforming entrepreneurial ecosystems, by improving innovation, knowledge production and businesses' competitiveness. There is however little empirical evidence so far about the role of AI capability, entrepreneurial competencies, innovation support and building a Sustainable AI Entrepreneurial Ecosystem (SAIEE) and entrepreneurial success in emerging economies. The findings of this study, which explores the relationship between AI competency, entrepreneurial skills, support for innovation, SAIEE and entrepreneurial success, are significant for the technology startup landscape in Pakistan. For this purpose, quantitative and cross-sectional research design has been used and for the sake of this research, 250 young entrepreneurs of AI-based startups and technology-oriented Small and Medium Enterprises (SMEs) from Lahore and Karachi have been chosen as respondents. Partial Least Squares Structural Equation Modeling (PLS-SEM) was used for analyzing the proposed framework. The results reveal that the capability of the AI, entrepreneurial competencies and the support of innovation play a significant role in the development of a sustainable AI entrepreneurial ecosystem. Moreover, SAIEE has a positive effect on entrepreneurial success and acts as a mediator between the antecedent variables and entrepreneurial success. The model shows good reliability, validity, explanatory value and predictive value. The study builds on the Resource Based View theory in a unique way as it emphasizes the need for a collaborative environment of AI technology, entrepreneurial competencies and institutional support. The research has implications for policymakers, universities, incubators, investors and entrepreneurs looking to foster entrepreneurship that is sustainable and uses AI.

Keywords: AI capability, Entrepreneurial competencies, Innovation support, Sustainable AI entrepreneurial ecosystem, Entrepreneurial success

Challenges for Biodiversity Conservation and Circular Economy: A Policy Perspective for Sustainability in Developing World

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Three diverse such as control of wastes and pollutants, circulation of products and materials and promotion of natural regeneration are needed to achieve circular economy. Many of the sustainable development goals are significantly achievable through continuous circulation of products through processes such as reuse, maintenance, recycling and composting. These processes entail effective tackling of climate change, biodiversity loss and pollution control by the decoupling of economic activity to conserve finite resources. Biodiversity being highly sensitive to increased consumption and commercial stimuli can well become sustained if the principles of circular economy are put into practice but this needs a strong policy framework and guidelines to promote regeneration of nature. On one side, the biodiversity conservation is an effect of the circular economy (cause). Yet there are voices that put the link the other way. Once a drive for biodiversity conservation is launched, there emerge many forward linkages mediating circular economy as the former would heavily rely on nature conservation and waste control, thus, complementing achievement of the later. Nevertheless, there are numerous challenges that hinder this realization – mainly emanating from business motives, consumption behavior with majority of masses having materialistic goals rather than utilitarian goals and environmental degradation through increased movements, excessive monoculture, specie-specific killing/slaughtering of fauna and deforestation to meet food/fuel demands. All these actions and interventions lead to compromised flora and fauna. The path to circular economy, thus, is heavily dependent on carefully conserved and smoothly nurtured biological capital of any ecosystem. With this in mind, excessive population pressure would still undermine any effort to promote biodiversity and hence circular economy in a wider context.

Keywords: Sustainability, Ecosystem, Diversification, Dividend, Monoculture

Digital Financial Literacy as a Pathway to Financial Inclusion Among Women Entrepreneurs in Punjab, Pakistan

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Financial literacy and digital financial literacy play an important role in entrepreneurial development. The capability of using digital financial tools has become increasingly pertinent for entrepreneurs. This research examines gender differences in financial literacy, digital financial literacy and financial inclusion among entrepreneurs in Punjab, Pakistan, with particular focus on women entrepreneurs and the role of digital financial literacy in enabling them access formal financial services. A mixed-method research design was applied. The gender dimensions of financial literacy and financial inclusion in Pakistan were firstly checked using data from the World Bank's Global Findex database. The primary data was collected using a structured questionnaire from 237 selected entrepreneurs from Faisalabad, Punjab. The sample included 137 male entrepreneurs (58 %) and 100 female entrepreneurs (42 %). The findings point out significant differences between male and female entrepreneurs in terms of financial literacy, digital financial literacy and financial inclusion. Women entrepreneurs had quite lower levels across these dimensions. The empirical examination further directs towards a positive relationship between digital financial literacy and financial inclusion, suggesting that greater acquaintance with digital financial tools is linked to better engagement with formal financial services. These findings emphasize the significance of enhancing women entrepreneurs' digital and financial abilities as part of wider efforts for promoting inclusive entrepreneurship. Strengthening digital financial literacy, facilitating financial inclusion and enhancing entrepreneurial support mechanisms may facilitate creating an empowering setting for women-owned enterprises. Such actions may support better financial inclusion and improve the economic empowerment of female entrepreneurs in Punjab.

Keywords: Digital financial literacy, Financial inclusion, Women entrepreneurs, Financial literacy, Pakistan

INNOVATION, ENTREPRENEURSHIP AND INDUSTRY LINKAGES

POSTER

PRESENTATIONS

Financial Constraints, Cash Holdings and Leverage: Evidence from Pakistan's Textile Sector

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This study examines the cash-debt paradox in Pakistan's financially constrained textile industry over the period 2014-2025, with particular focus on why firms facing similar financial constraints adopt different liquidity and financing strategies. It further investigates the moderating roles of profitability and industry-level shocks, particularly the COVID-19 pandemic, in shaping firms' financial decisions. Using balanced panel data from 25 PSX-listed textile firms comprising 275 firm-year observations, the study employs random-effects estimation for cash-holding models and fixed-effects estimation for leverage models. Financial constraints are measured using the Kaplan–Zingales (KZ) Index. Data are obtained from the State Bank of Pakistan's Balance Sheet Analysis, Pakistan Bureau of Statistics, PSX-listed firms' annual reports and other sector-specific sources. The findings indicate that financial constraints have a significant negative effect on corporate cash holdings and a significant positive effect on leverage, suggesting that financially constrained textile firms maintain lower liquidity reserves while relying more heavily on debt financing. The moderation analysis further shows that profitability mitigates the adverse effect of financial constraints on cash holdings and reduces firms' reliance on leverage. The COVID-19 pandemic also altered firms' financial behavior by strengthening precautionary cash-holding motives and constraining access to external financing among highly financially constrained firms. The study contributes to industry-oriented financial decision-making by highlighting how financial constraints shape firms' ability to maintain liquidity, access external finance and respond to industry-level disruptions. The findings provide practical insights for textile-sector managers, financial institutions, entrepreneurs and policymakers seeking to strengthen financial resilience, support business continuity and facilitate sustainable industrial growth in Pakistan.

Keywords: Financial constraints, Cash holdings, Leverage, industry shocks, Textile Industry

Comparative Analysis of National Education Policies: Pakistan vs. Finland in Preparing Future-Ready Generations

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This study comparatively examines the national education policies of Pakistan and Finland, focusing specifically on their respective strategic approaches to preparing upcoming generations for the complex demands of the twenty-first century. The primary purpose of this investigation is to evaluate how both national policy frameworks address essential educational dimensions, including curriculum development, teacher preparation, assessment methodologies, digital integration, educational equity and the cultivation of core competencies such as critical thinking, creativity, problem-solving, collaboration and innovation. Employing a qualitative comparative research methodology, the study systematically analyzes key structural differences, shared systemic challenges and contextually adaptable practices across the two distinct educational frameworks. The findings reveal that Finland's national education system emphasizes student-centered learning environments, high teacher autonomy, competency-based education, social equity and interdisciplinary learning approaches. Conversely, Pakistan continues to encounter pronounced operational and systemic challenges related to educational inequality, severe resource limitations, constrained teacher capacity, rigid curriculum implementation and unequal access to digital learning technology. The study concludes that Pakistan can significantly enhance its institutional future-readiness by strengthening continuous teacher professional development, institutionalizing inquiry- and project-based learning methodologies, integrating multidisciplinary STEAM approaches, implementing competency-based curricula and expanding equitable access to digital learning opportunities. Importantly, the study emphasizes that Finnish educational practices should not be directly replicated, but must be thoughtfully and strategically adapted to Pakistan's specific socioeconomic, cultural and educational context. Ultimately, this comparative research provides essential policy-oriented insights for constructing an inclusive, innovative and future-ready education system capable of equipping all learners with the vital competencies required to successfully navigate emerging global challenges.

Keywords: Education policy, STEAM Education, Teacher professional development, Future-ready skills

Innovation, Governance and Sustainability: Rethinking Business Growth in a Changing Global Economy

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Businesses today face challenges due to technological changes, economic uncertainty and environmental concerns. This study examines how innovation, governance and sustainability can support business growth in the changing global economy. It discusses how digital transformation, artificial intelligence (AI) and new technologies can improve productivity and create business opportunities. It also highlights the importance of good governance in promoting transparency, accountability and trust. Furthermore, the paper explains how sustainable practices, such as energy efficiency, waste reduction, renewable energy and responsible resource use, can help businesses reduce costs and manage risks. Examples from companies such as Ørsted, Apple and Microsoft illustrate how organizations are addressing innovation and sustainability challenges. Drawing on reports from international organizations and corporate examples, the paper presents a conceptual framework connecting innovation, governance and sustainability to achieve long-term business growth. It emphasizes that businesses need to adopt new technologies responsibly, improve management practices, strengthen accountability and consider environmental impacts in their decisions. The paper also highlights the importance of developing employee skills, improving supply chain resilience and using resources efficiently. These insights can help business leaders and policymakers develop strategies that balance economic performance with environmental responsibility and support sustainable business development in an increasingly changing global economy.

Keywords: Innovation, Governance, Sustainability, Digital transformation, Business growth, Artificial Intelligence

Designing Human-in-the-Loop Ethical Frameworks for Artificial Intelligence Driven Resource Allocation in Project Environments

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As highly advanced artificial intelligence systems increasingly assume direct, autonomous control over critical administrative project management tasks, highly significant ethical concerns regarding algorithmic bias and systemic unfairness are rapidly emerging. While autonomous AI excels at strictly mathematically optimizing project resource allocation and complex scheduling dependencies, these purely data-driven systems often completely ignore critical human factors, such as employee burnout, personal wellbeing, and equitable workload distribution. This rigorous academic research paper critically investigates the absolute necessity of intentionally designing robust Human-in-the-Loop (HITL) operational frameworks specifically for AI-driven project management software. The primary scientific objective is to empirically determine how maintaining deliberate human oversight over algorithmic resource allocation directly affects overall team morale and long-term talent retention. Through an extensive qualitative and quantitative analysis of twenty global technology firms utilizing advanced AI scheduling tools, the researchers meticulously evaluated the immense social impact of entirely autonomous AI management versus heavily supervised HITL hybrid models. The compelling findings clearly demonstrate that teams managed by entirely autonomous, unsupervised AI experienced a highly alarming twenty-eight percent increase in reported daily burnout rates. Conversely, project teams operating under a structured HITL framework—where human project managers actively reviewed and deliberately ethically adjusted the AI's automated resource assignments—maintained exceptionally high job satisfaction while still retaining seventy percent of the AI's raw computational efficiency. The abstract firmly concludes that ethical AI implementation in project environments strictly requires permanent, mandatory human oversight to preserve equity.

Keywords: Project management, Human-in-the-Loop, Ethical AI, Resource allocation, Algorithmic bias

Household Food Waste and Food Production Inefficiency: Empirical Evidence from South Punjab, Pakistan

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Food waste and inefficiencies in food production have become an international concern. The huge amount of food waste not only leads to economic losses, food insecurity and inefficient utilization of resources but also related to environmental impacts. Pakistan is among the countries that are facing severe food related challenges such as food waste, food insecurity and production inefficiencies. Limited research has explored food waste along with production inefficiencies, leaving a notable research gap. Thus, the present study finds out the food waste due to production inefficiencies at households' level. The data collected through multistage random sampling technique from three districts (Multan, Bahawalpur and Vehari) in South Punjab with the help of structured questionnaire. The questionnaire captures the detailed information on food wastage, food consumption and input utilization from 400 households. Stochastic Frontier Analysis (SFA) is applied to estimate efficiencies at household level and analysis the inefficiencies in the context of input-oriented inefficiency and output-oriented inefficiency. The findings provide realistic evidence for designing targeted policies that promote sustainable consumption, reduce food waste and improve resource efficiency in the region.

Keywords: Household food waste, Food production inefficiency, Stochastic, Resource use efficiency, Sustainable food consumption

Analysis of Non-Newtonian Fluid by Heat and Mass Transport with Surface Chemical Reaction

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Newtonian fluid exhibits both liquid and solid qualities. A non-Newtonian fluid can sometimes flow as a liquid and, under other conditions, possess elasticity, plasticity, and hardness like solids. Given the importance of the non-Newtonian Walter's B fluid, it is intended to explore how heat and mass affect the fluid along the highest horizontal catalytic surface of the paraboloid. Utilizing the law of conservation of mass, momentum, heat, and concentration, the flow problem of a two-dimensional Walter's B fluid is discussed. To meet the objectives of the study, paired non-linear PDEs are transformed into non-linear ODEs by using the stream function and similarity transformation. The numerical results of the nonlinear ODEs are obtained by using the shooting technique along with Rung-Kutta fourth-order (RKF) approach. Graphs and tables are produced by using MATLAB software to see the impact of physical parameters such as skin friction coefficient, the Nusselt number, and Sherwood number, thermal Grashof number Gt, thickness α_1, and chemical reaction ξ parameters calculated and evaluated against temperature, velocity, and concentration.

Keywords: Heat and mass transfer, Non-Newtonian fluid, Surface chemical reaction

Statistical Monitoring of Drinking Water Quality Using Multivariate Control Charts: Evidence from Faisalabad, Pakistan

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This study investigates the use of multivariate statistical process control techniques for monitoring drinking water quality at a treatment facility in Faisalabad, Pakistan. Five key water-quality parameters—turbidity, nitrate (N), fluoride (F), arsenic (As), and iron (Fe)—were considered in the analysis. Unlike conventional univariate control charts, which generally monitor quality characteristics individually, multivariate control charts account for the relationships among multiple quality variables simultaneously. The analysis considers different covariance estimation approaches, including the sample covariance matrix, successive-differences estimator, and minimum volume ellipsoid estimator. The initial monitoring phase identified several out-of-control observations, which were subsequently investigated and removed to establish stable control limits. Following this adjustment, the multivariate control charts indicated that the process was statistically stable. A Monte Carlo simulation study was then conducted to further examine the behavior of the control charts under simulated conditions. The simulation results showed that the charts remained within their respective control limits, supporting their applicability for monitoring changes in the joint behavior of drinking water quality parameters. Overall, the findings demonstrate the potential of multivariate statistical process control as a useful approach for assessing and monitoring drinking water quality at treatment facilities.

Keywords: Drinking water quality, Multivariate control charts, Statistical process control, Water quality monitoring, Process stability

Interval Estimation of Multivariate Process Capability Index Using Different Bootstrap Methods

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Process capability indices (PCIs) serve as indispensable statistical measures for monitoring, assessing, and evaluating industrial manufacturing performance to verify whether a production system operates within predefined quality tolerance limits. While traditional univariate capability indices such as Cp, Cpk, Cpm, and Cpmk are extensively applied in single-characteristic quality control, modern industrial and engineering manufacturing processes routinely exhibit multiple interdependent quality characteristics simultaneously. The formulation of novel MPCIs and the rigorous comparative performance evaluation of existing capability metrics under diverse operational scenarios constitute a vital research direction in contemporary statistical quality engineering. This study evaluates the operational performance of the multivariate process capability index MC(1)pm under low, moderate, and highly correlated variable conditions using an extensive Monte Carlo simulation study. In addition, the research focuses on statistical interval estimation by assessing four distinct bootstrap confidence interval methods: normal, standard, percentile, and bias-corrected (BCa) bootstrap intervals. The empirical simulation results demonstrate that under highly correlated multivariate process conditions, the MC(1) pm index performs significantly better and exhibits higher diagnostic precision. Furthermore, as the sample size increases, the estimated numerical value of the MC(1) pm index systematically decreases. Regarding confidence interval estimation, empirical findings indicate that the bias-corrected (BCa) bootstrap confidence interval is strongly recommended for manufacturing processes with highly correlated variables due to its noticeably smaller average interval width when compared to normal, standard, and percentile confidence interval techniques, thereby providing practical guidance for industrial quality control practitioners.

Keywords: Multivariate process capability index, Bootstrap confidence interval, MC(1) pm, Bias-corrected (BCa) method, Process capability indices

Immobilization of Xylanase on ZnO Chitosan Coated Nanoparticles: An Innovative Approach to Enhance Stability of Xylanase for Application in Poultry Feed

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Xylanase is one of the important enzymes with numerous uses in industries and in poultry feed but low stability of the enzyme under altered environmental conditions limits its effectiveness in different applications. The aim of this study was to enhance the stability of xylanase by immobilization of xylanase onto chitosan coated ZnO nanoparticles. Xylanase which was produced by *A. niger* and then purified, had specific activity of 24.203 U/mg and 39.29% purification yield. The ZnO nanoparticles were characterized through SEM, FTIR, XRD, Zeta Sizer and Zeta Potential, these approaches confirmed successful synthesize of ZnO nanoparticles. The immobilized xylanase on ZnO nanoparticles exhibited 67.92% immobilization yield, an immobilization efficiency of 58.96% and an activity recovery of 40.05%. The stability of free enzyme and the immobilized enzyme to various conditions like different temperature, pH and metal ions were tested and results showed that immobilized xylanase retained high residual activity over wide range. Variations in kinetic parameters (K_m 3.174 mg/mL, 26.681 mg/mL), (V_{max} 1.1024 U/mL, 17.39 U/mL) of free and immobilized xylanase respectively, indicated that enzyme-substrate interactions had been altered. Further, the enzyme's implication had been evaluated using its *in vitro* feed digestion, results indicated that immobilized enzyme released a higher amount of nutrient and displayed an enhanced digestion efficiency with less crude fiber quantity of 3.36% as in comparison to the free enzyme. From the results, it has been summarized that immobilization of xylanase onto the ZnO nanoparticles is a potential strategy to improve the utilization of xylanase, which has great opportunity in poultry feed formulation and processing industries applications.

Keywords: Xylanase, ZnO Nanoparticles, Stability, Immobilization, Characterization

From Digital Tools to Market Growth: How AI-Supported Marketing May Help Pakistani SMEs Reach New Customers

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Pakistani small and medium-sized enterprises (SMEs) increasingly have access to artificial intelligence (AI) tools for content creation, customer analysis and campaign management, yet many lack clear guidance on how these tools may support innovation and reach new markets. This proposed study aims to examine how AI-supported marketing use may relate to market reach through marketing innovation and customer engagement among Pakistani SMEs. Drawing on the resource-based view and dynamic capabilities perspective, the study proposes that firms using AI-supported marketing may develop more adaptive and innovative marketing practices. These practices may strengthen customer engagement, which may help firms connect with new customer groups and markets. The study tests a sequential model in which marketing innovation and customer engagement mediate the proposed relationship between AI-supported marketing use and perceived market reach. A cross-sectional survey is conducted with owners or marketing decision-makers of small and medium-sized firms in selected Pakistani cities and sectors, including retail, e-commerce, food and services. Questionnaire measures were adapted from established research, reviewed for relevance to the local context and pilot-tested before the main data collection. The proposed relationships and indirect effects were assessed using partial least squares structural equation modelling, subject to sample adequacy and measurement quality. The study is expected to offer a context-specific framework for understanding how AI-enabled marketing may translate into marketing innovation, customer engagement and perceived market reach, while identifying practical considerations for entrepreneurs and industry support initiatives.

Keywords: AI-supported marketing, Marketing innovation, Customer engagement, SMEs, Market reach

Impact of Green Human Resource Management Practices on Employee Performance

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Growing environmental concerns and increasing stakeholder pressure have encouraged organizations to integrate sustainability into their business strategies and human resource management practices. Green Human Resource Management (GHRM) has consequently emerged as an important approach through which organizations can promote environmentally responsible employee behavior while improving workplace outcomes. Despite increasing scholarly attention, empirical evidence regarding the effectiveness of GHRM practices remains relatively limited in developing economies such as Pakistan. This study aims to examine the impact of GHRM practices on employee performance, with particular emphasis on employee efficiency and employee engagement. GHRM practices, including green recruitment and selection, green training and development, green performance management and green rewards and compensation, are considered important organizational mechanisms for developing employees' environmental knowledge, motivation and commitment. A quantitative, cross-sectional research design was used to collect data from employees working in organizations in Pakistan through a structured questionnaire using previously validated measurement scales. The proposed relationships were examined using appropriate statistical techniques to determine the extent to which GHRM practices contribute to improved employee outcomes. The study finds that greater implementation of GHRM practices positively influences employee efficiency and engagement by creating a supportive organizational environment that encourages employees to participate actively in sustainability initiatives and perform their responsibilities more effectively. The findings contribute to the growing literature on sustainable human resource management by providing evidence from a developing-country context. Practically, the study assists managers and HR professionals in designing environmentally responsible HR policies that simultaneously support organizational sustainability and enhance employee performance.

Keywords: Green human resource management, Employee performance, Employee efficiency, Employee engagement, Environmental sustainability

Welfare Impact of Transfer Decisions and Financial Competence among BISP and non-BISP Beneficiaries: Evidence from Vehari

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Social safety net programs play a significant role in reducing poverty. Benazir Income Support Program (BISP) is one of the largest programs that targets poor women and tries to sustain their livelihoods in Pakistan. A number of studies have examined the role of BISP in empowering women and the spending behavior of the beneficiaries. Considering the importance of BISP in terms of welfare and perceived financial competence is important factor. This study was designed to evaluate perception-based financial competence and welfare effects of intra-household cash transfer decisions of BISP beneficiaries and non-beneficiaries. For this cross-sectional study, a total of 384 respondents from same socioeconomic group of BISP recipients and non-recipients were selected to compare the welfare effects while considering perceived market competence. Propensity score matching (PSM) was used to evaluate the impact of the unconditional cash transfer on economic well-being of the recipients and non-recipients. Descriptive statistics showed a significant difference between BISP beneficiaries and non-beneficiaries. The proportion of government school enrollment is relatively high in treatment group because most of the beneficiaries were receiving conditional cash transfers for education. Meanwhile, trust and market expertise reputation are used for perceived financial competence for both groups and there was a significant mean difference between groups, with a significant impact on school enrollment.

Keywords: Benazir income support program, Financial competence, Cash Transfers, Economic well-being, School enrollment

The Role of Educational Institutions in Fostering Innovation and Entrepreneurship: Institutional Support, Entrepreneurial Ecosystems and the Hurdles Faced by Young Entrepreneurs

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Educational institutions, particularly universities and higher education institutions (HEIs), have increasingly become important actors in promoting innovation, entrepreneurship and employment creation. Their role has expanded beyond conventional knowledge transmission toward developing entrepreneurial competencies, supporting technology commercialization, facilitating industry linkages and creating entrepreneurial ecosystems through incubators, accelerators, mentoring and networking platforms. Nevertheless, young entrepreneurs continue to encounter substantial barriers, including limited access to finance, inadequate entrepreneurial and digital skills, fear of failure, weak market networks, regulatory constraints, insufficient mentoring and difficulties in converting entrepreneurial intentions into actual venture creation. Recent evidence indicates that experiential education, extracurricular activities, university-industry collaboration, incubation, mentoring, and start-up support can strengthen the transition from entrepreneurial intention to entrepreneurial action. However, institutional effectiveness depends on the broader entrepreneurial ecosystem, including financing, regulatory conditions, digital infrastructure, social support and market access. The study proposes an integrated institutional support model and identifies directions for future empirical research, particularly in emerging economies such as Pakistan. The framework provides implications for university administrators, policymakers, educators, incubators and industry stakeholders seeking to strengthen youth entrepreneurship and innovation.

Keywords: Entrepreneurship education, Innovation, Young entrepreneurs, Higher education institutions, Pakistan

Impact of Artificial Intelligence-Driven Green Marketing on Green Purchase Intention: Role of Trust and Price Sensitivity

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Artificial intelligence (AI) is transforming marketing through personalization, predictive analytics, data-driven decision-making and enhanced consumer engagement. Its integration with green marketing offers new opportunities for promoting environmentally responsible products and encouraging sustainable consumption. However, limited research has examined how AI-driven green marketing influences consumers' green purchase intention, particularly through consumer trust and under different levels of price sensitivity. This study aims to investigate the impact of AI-driven green marketing on green purchase intention among consumers in the Pakistani cosmetics industry, with consumer trust as a mediator and price sensitivity as a moderator. A quantitative, cross-sectional survey was conducted among cosmetic consumers aged 18–50 years in Faisalabad, Punjab, Pakistan. Using convenience sampling, data were collected from 200 respondents through a structured questionnaire comprising previously validated measures and a five-point Likert scale. Data were analyzed using SPSS and SmartPLS to assess descriptive statistics, measurement reliability and validity, direct relationships, mediation and moderation effects. Based on existing literature, AI-driven green marketing positively influences both consumer trust and green purchase intention, while greater consumer trust enhances consumers' intention to purchase environmentally responsible cosmetic products. Consumer trust further mediates the relationship between AI-driven green marketing and green purchase intention. Price sensitivity significantly moderates the trust-purchase intention relationship, such that greater price sensitivity weakens consumers' willingness to translate trust into green purchasing intentions. The study contributes by integrating AI-driven green marketing, trust, price sensitivity and green purchase intention within a unified framework and offers practical implications for cosmetic brands seeking credible, technology-enabled green marketing strategies.

Keywords: AI-Driven green marketing, Green purchase intention, Consumer trust, Price sensitivity, Sustainable consumer behavior

Strengthening Pharmacy Education for Industry Readiness: Addressing Competency Gaps and Emerging Pharmaceutical Sector Demands

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Pharmacy education plays an important role in preparing graduates for professional practice by providing a strong foundation of pharmaceutical knowledge. However, pharmacy students may experience a gap between academic learning and the practical competencies and professional expectations of the pharmaceutical industry, which can affect their confidence and transition from university to employment. This study aims to assess Pharm-D students' perceptions of the alignment between their academic education and the skills required by the pharmaceutical industry and to identify key areas where additional training and development are needed. A cross-sectional survey was conducted among Pharm-D students in Pakistan using a structured questionnaire based on a five-point Likert scale. The questionnaire assessed students' perceptions of their preparedness in areas including practical training, Good Manufacturing Practices (GMP), quality assurance, quality control, pharmaceutical manufacturing, regulatory affairs, communication skills, internships and industry exposure. The collected data were analyzed using descriptive statistics to identify perceived competency gaps and areas requiring greater educational attention. The study highlights areas in which pharmacy students feel insufficiently prepared for pharmaceutical industry roles and demonstrate the importance of greater practical and industry-oriented learning. The findings may assist pharmacy institutions in strengthening industry readiness through enhanced practical training, structured internships, closer university–industry collaboration and curricula that better reflect contemporary pharmaceutical sector requirements. Ultimately, addressing these competency gaps may facilitate students' transition into professional roles and contribute to developing a pharmacy workforce better prepared for the evolving needs of the pharmaceutical industry.

Keywords: Pharmacy education, Pharmaceutical industry, Industry readiness, Competency gaps, Curriculum alignment

Augmented Reality Cosmetic Virtual Try-On and Purchase Intention: The Roles of Consumer Value, Attitude and Perceived Personalization

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Augmented reality (AR) has increasingly transformed online cosmetic shopping by enabling consumers to virtually try products before making purchase decisions. Drawing on the Stimulus–Organism–Response (S-O-R) theory, this study examines how AR experience quality influences consumers' cosmetic purchase intention through utilitarian value, hedonic value and attitude toward AR cosmetic virtual try-on (VTO). The study further investigates the moderating role of perceived personalization in strengthening the value generated through AR experiences. Data were collected from cosmetic consumers using a structured questionnaire and purposive sampling, with participation restricted to respondents who had prior experience using AR-based cosmetic VTO applications or features. The findings reveal that AR experience quality significantly enhances both utilitarian and hedonic value, indicating that an effective AR-VTO experience provides consumers with functional benefits while simultaneously making cosmetic shopping more enjoyable and engaging. Consumer value subsequently contributes to a more favorable attitude toward AR-VTO and strengthens cosmetic purchase intention. The results further demonstrate that perceived personalization significantly strengthens the value-generating effects of AR experience quality, suggesting that consumers respond more positively when virtual try-on experiences are tailored to their individual preferences and characteristics. Overall, the findings highlight the importance of combining high-quality AR functionality with personalized experiences to improve consumer evaluations and purchase decisions. The study contributes to AR-enabled retailing literature by explaining the psychological mechanisms through which AR-VTO influences consumer behavior and provides practical implications for cosmetic brands seeking to design more effective, engaging and personalized digital shopping experiences.

Keywords: Augmented reality, Cosmetic virtual try-on, AR experience quality, Utilitarian value, Purchase intention

AI Influencers and Brand Trust in Student Ventures: The Role of Founder Accountability

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The increasing use of artificial intelligence (AI) influencers provides new promotional opportunities for student-led ventures but also raises important concerns regarding transparency, credibility and consumer trust. This conceptual study examines how AI influencer disclosure and founder accountability influence brand trust in student ventures in Pakistan. Drawing on the Persuasion Knowledge Model and source credibility theory, the study develops a conceptual framework explaining consumers' responses when businesses explicitly disclose the artificial nature of an AI influencer. While clear AI disclosure may enhance perceived honesty by signaling transparency, awareness that an influencer is artificially generated may simultaneously create doubts about its credibility, potentially weakening brand trust. The framework further proposes founder accountability as an important boundary condition that can mitigate such concerns. When an identifiable founder accepts responsibility for AI-generated promotional claims, verifies communicated information and responds to consumers, the positive effect of perceived honesty on brand trust is expected to strengthen. The proposed framework therefore integrates AI disclosure, perceived honesty, credibility concerns, founder accountability and brand trust, while suggesting purchase intention as a potential downstream consequence of brand trust. The study contributes to emerging research on AI-enabled marketing by shifting attention from AI influencers alone toward the human accountability mechanisms surrounding their use. It also provides practical implications for student entrepreneurs, university incubators and industry mentors by emphasizing transparent AI disclosure and identifiable human responsibility as complementary mechanisms for responsible digital marketing. Future empirical research can test the proposed relationships through controlled experiments in which AI disclosure and founder accountability are systematically manipulated.

Keywords: AI influencers, Founder accountability, Brand trust, AI disclosure, Student ventures

Said vs. Silicon: Stated Rationales and the Compute Motive in Great-Power Policy

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Compute, meaning the capacity to process data through advanced chips, chip-making equipment, and data centers, has become a strategic resource in international politics. This article examines how access to and control over compute shapes major state decisions that are publicly justified on other grounds, such as national security, ethics, or economic policy. It draws on weaponized interdependence and securitization theory, which together explain how states use technological chokepoints and present issues as security concerns to justify extraordinary measures. The article adopts a qualitative, comparative methodology based on a multiple case study of four policy decisions: United States export controls on China, Gulf state chip agreements, Taiwan's position as a critical chip manufacturer and China's export controls on critical minerals. This study adopts a structured analytical framework that compares each decision officially stated rationale with its observable compute-related effects, including timing, targets and outcomes. Data are drawn from official government statements, legislation and regulatory texts, policy reports from think tanks and international organizations and reputable news coverage. The analysis combines discourse analysis of stated justifications with pattern tracing across cases to identify consistent compute-related outcomes. The study concludes that compute functions as a form of geopolitical currency, as it is traded, restricted and used to reward or constrain other states. Analyzing policy through this lens reveals motives that official narratives leave out. The article recommends that scholars and policymakers treat compute access as a core variable in international relations analysis and that future research extend this framework to middle powers and Global South states.

Keywords: Compute geopolitics, Weaponized interdependence, Securitization, Export controls, Techno-nationalism

Eliminating Information Silos: The Strategic Integration of Enterprise Resource Planning and Modern Project Management Systems

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Historically, organizations have managed projects using highly fragmented software ecosystems, creating severe information silos that isolate project data from broader enterprise resource planning (ERP) and customer relationship management (CRM) platforms. This structural fragmentation often leads to massive data duplication, chronic reporting inaccuracies and fundamentally misaligned strategic objectives. This comprehensive research paper critically examines the rapidly accelerating global trend of deploying unified, highly interoperable digital ecosystems within complex enterprise project management frameworks. The core objective of this extensive study is to empirically evaluate how establishing a single, undisputed operational source of truth across all major departments actively influences overall organizational alignment and significantly reduces costly administrative friction. Utilizing a rigorous comparative methodology, researchers meticulously analyzed performance data from thirty multinational corporations that successfully integrated their previously isolated project management tools directly into their central ERP platforms during the 2025 fiscal year. The resulting quantitative findings are incredibly striking. Organizations that successfully achieved seamless digital interoperability actively reduced their cross-departmental communication delays by a remarkable thirty-eight percent. Furthermore, by completely automating real-time financial data synchronization between project execution teams and corporate finance departments, these progressive companies successfully eliminated nearly all manual data entry errors. The study concludes that isolated project tools are rapidly becoming obsolete.

Keywords: Project management, Digital ecosystems, Enterprise resource planning, Interoperability, Information silos

From Soft Power to Digital Power: The Changing Instruments of State Influence

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The rapid expansion of digital technologies is transforming the ways states exercise influence in international politics. Traditionally, soft power has been associated with a state's ability to achieve desired outcomes through attraction, culture, values, diplomacy and international reputation. However, the rise of social media, digital diplomacy, artificial intelligence, cyber capabilities, online platforms and control over digital information has created new instruments through which states can shape perceptions, narratives, relationships and strategic behavior. This study examines the transformation from conventional soft power toward what can be understood as digital power, focusing on how digital technologies are reshaping state influence in the contemporary international system. The study adopts a qualitative, conceptual approach based on an analysis of existing academic literature, policy discussions and selected examples of state use of digital platforms and technologies. It examines digital diplomacy, strategic communication, information influence, artificial intelligence and cyber capabilities as emerging dimensions of state power. The analysis indicates that digital technologies have expanded the speed, reach and accessibility of state influence, allowing governments to communicate directly with foreign publics and participate in global narratives beyond traditional diplomatic channels. At the same time, digital power introduces new challenges, including disinformation, manipulation of online narratives, cyber insecurity, digital dependency and unequal access to technological resources. The study concludes that digital power does not replace soft power but transforms and extends its instruments in an increasingly interconnected international environment. Understanding this shift is therefore important for analyzing contemporary state behavior, diplomacy, geopolitical competition and the changing distribution of influence in global politics.

Keywords: Soft power, Digital power, Digital diplomacy, State influence, International relations

Turning Pharmacy Student Research into Innovation: Factors Influencing Commercialization in Pakistan

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Many pharmacy students in Pakistan complete final-year research projects that generate potentially valuable ideas, including herbal formulations, low-cost pharmaceutical preparations, improved drug-delivery approaches and innovative pharmacy services. However, most of these research outputs remain confined to academic requirements and are rarely translated into marketable products or services. This study examines the factors that facilitate or hinder the translation of pharmacy student research into innovation and commercialization. Specifically, it investigates the influence of research training, faculty mentorship, access to laboratory facilities and funding and industry exposure on innovation output and students' intention to commercialize their research. A cross-sectional quantitative survey was conducted among 150 pharmacy students in Punjab, Pakistan, selected through purposive sampling. Data were collected using a structured Google Forms questionnaire comprising five-point Likert-scale measures of the study constructs. Descriptive statistics, correlation analysis and regression analysis were employed to examine the relationships among the variables and identify the factors that most strongly predict innovation output and commercialization intention. The findings identify the institutional and resource-related factors that shape students' ability and willingness to transform academic research into commercially viable products and services. They further demonstrate whether the persistent research-to-market gap primarily results from a shortage of innovative ideas or inadequate mentorship, funding, infrastructure and industry engagement. The study provides practical implications for pharmacy colleges by emphasizing stronger research mentorship, accessible seed funding, improved laboratory support, entrepreneurship training and closer collaboration with pharmaceutical companies and business incubators. Strengthening these mechanisms can promote research commercialization, student entrepreneurship and pharmacy-led innovation in Pakistan.

Keywords: Pharmacy research, Innovation, Commercialization, Entrepreneurship, Industrial linkages

The Impact of Green Financing on Firm's Profitability in Pakistan: The Moderating Role of Corporate Governance

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This study investigates the empirical relationship between green financing initiatives and firm profitability within the emerging economic context of Pakistan. As environmental sustainability becomes increasingly integrated into corporate strategy and financial regulation, understanding the economic returns on sustainable investments is paramount for managers and policymakers alike. Utilizing a panel dataset of commercial banks in Pakistan, this research evaluates how green credit and eco-friendly capital allocation influence key financial performance metrics, specifically return on assets and return on equity. Furthermore, the study examines the moderating effects of corporate governance quality to uncover the conditions under which green financing yields optimal financial outcomes. Employing panel data regression techniques, the findings indicate that green financing exerts a positive impact on firm profitability, supporting the view that sustainable practices enhance long-term operational efficiency and stakeholder value. Crucially, strong corporate governance structures-characterized by board independence, effective audit mechanisms, and transparent disclosure-significantly strengthen the positive financial return of green financing by ensuring disciplined capital allocation and mitigating agency conflicts. These insights offer important practical implications for corporate leaders, banking institutions, and regulators in developing economies, highlighting that green financing should be coupled with robust governance practices and prudent risk management to maximize financial and environmental performance.

Keywords: Corporate governance, Green financing, Firm's performance, Financial sustainability

A Comparative Financial Performance Analysis of Islamic and Conventional Banks in Pakistan

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Pakistan's dual banking system presents an empirical setting where conventional and Islamic banks operate under the shared regulatory authority of the State Bank of Pakistan while competing for the same depositor and borrower base. Although the market share of Islamic banking has expanded rapidly, aggregate growth figures do not elucidate the multi-dimensional financial health of both paradigms. This study conducts a comparative financial performance analysis of Islamic and conventional commercial banks in Pakistan across the tumultuous five-year period from 2019 to 2023, capturing the structural shocks of post-pandemic recovery, historic inflationary pressures and aggressive monetary tightening. Employing the CAMEL framework-encompassing capital adequacy, asset quality, management efficiency, earnings quality and liquidity-this research utilizes secondary financial data extracted from audited annual reports and regulatory publications. The sample comprises six prominent commercial banks, featuring three fully-fledged Islamic banks (Meezan Bank Limited, Bank Islami Pakistan Limited and Dubai Islamic Bank Pakistan Limited) and three leading conventional peers (Habib Bank Limited, United Bank Limited and MCB Bank Limited). Financial ratio metrics, including Return on Assets (ROA), Return on Equity (ROE), and Cost-to-Income (C/I) ratios, are quantitatively evaluated alongside risk-sharing and asset-backed Shariah parameters. The empirical investigation examines whether statistically significant differences exist in financial resilience, liquidity buffers, and operating cost efficiencies between interest-based intermediation and faith-based participatory contracts. By contextualizing post-crisis performance disparities, the findings provide targeted empirical insights for regulatory policymaking, institutional asset-liability management and ethical investor capital allocation within developing dual-banking environments.

Keywords: Islamic banking, Conventional banking, Financial performance analysis, CAMEL framework, Dual banking system

From Digital Innovation to Financial Inclusion: FinTech Adoption Among Informal Entrepreneurs

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FinTech innovation offers new opportunities to strengthen financial inclusion and entrepreneurial activity, particularly among informal-sector entrepreneurs who remain underserved by traditional financial institutions in developing economies such as Pakistan. This study investigates the determinants of FinTech adoption among small-scale informal-sector entrepreneurs, with particular emphasis on the novel role of perceived responsiveness in connecting digital financial innovation with entrepreneurs' practical financial needs. Using fuzzy-set Qualitative Comparative Analysis (fsQCA), the study analyzes 388 valid survey responses collected from informal-sector entrepreneurs in Pakistan. The findings reveal multiple pathways to FinTech adoption, demonstrating that adoption results from different combinations of technological and user-related conditions rather than any single factor. Perceived responsiveness emerges as a critical condition across most configurations, highlighting the importance of timely assistance, supportive interaction and user-centered services in enabling entrepreneurs to engage with FinTech innovations. In contrast, traditional factors such as compatibility play a comparatively limited role among informal-sector users who prioritize trust, simplicity and accessible support. The findings strengthen the link between innovation and entrepreneurship by demonstrating that the effectiveness of FinTech innovation depends not only on technological functionality but also on its responsiveness to entrepreneurs' needs. The study offers implications for FinTech firms, financial institutions and policymakers to strengthen industry–entrepreneur linkages through responsive digital financial services tailored to low-literate and underserved informal-sector entrepreneurs.

Keywords: FinTech innovation, Informal-sector entrepreneurship, Perceived responsiveness, Financial inclusion

Impact of Price Discounts and Social Media Marketing on Consumer Impulse Buying Behaviour in Home-Based Cloud Kitchens: Evidence from Faisalabad

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Home-based cloud kitchen is an emerging concept that has altered the online food business market in Faisalabad, increasing competition and encouraging businesses to depend more on social media marketing and price discounts. This research is done to determine how online sales promotional components impact consumer impulse buying behaviour in cloud kitchens in Faisalabad. In Pakistan, the usage of online food ordering has created new opportunities for home-based cloud kitchen business owners, but limited research has examined how pricing and social media marketing strategies influence consumers' impulse buying behaviour. The model that is used in this research is S-O-R where price discount and social media marketing are used as a stimulus. These are the external factors that shape the customer's internal emotional response. Experiential satisfaction is used as an organism that represents how consumers feel during and after their online food ordering experience. A quantitative research design was used, and the primary data was collected from 200 cloud kitchen consumers in Faisalabad. The data was collected through the well-structured questionnaire and the responses were analysed through the statistical analysis to find the link between the variables by using the Smart PLS. The findings reveal that the social media marketing has a positive significant effect on impulse buying while the effect of price discounts on impulse buying is also positive. The role of experiential satisfaction is also significant and positive. This study provides valuable insights to the home-based cloud kitchen owners to develop effective strategies relevant to price discounts and social media marketing for improving customer experiences and increase satisfaction.

Keywords: Home-Based, Cloud kitchens, Price discounts, Social media marketing, Experiential satisfaction, Impulse buying behavior

Factors Influencing the Bargaining Power of Mango Growers in Punjab

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Mango growers in Punjab's core mango belt operate in marketing systems dominated by contractors, where pre-harvest contracting, limited storage and volatile prices weaken their negotiating position. Understanding what shapes growers' bargaining power is essential for building equitable, innovation-driven and future-ready agricultural value chains, yet growers are often treated as a uniformly weak group. This study aimed to identify grower segments based on bargaining power, determine the factors shaping bargaining power and propose measures to strengthen the bargaining position of mango growers in Punjab's core mango belt. A quantitative, cross-sectional survey was conducted in Multan, Khanewal/Kabirwala and Muzaffargarh using a structured five-point Likert-scale questionnaire and a two-stage purposive-cum-proportionate sampling procedure. A conceptual framework linked market information, market access, farm input resources, social and collective action and government support to bargaining power. Growers were classified as weak, moderate, or strong and ordinal logistic regression was applied. Growers formed a heterogeneous population across the three bargaining-power categories, indicating that they should not be treated as a uniformly weak group. Access to markets, access to market information, farm input resources and social and collective action were positively and significantly associated with higher bargaining power, while government support had no significant effect. Marketing was contractor-dominated, pre-harvest contracting prevailed, storage and farmer-organization membership were limited and price fluctuations were the most-cited constraint. The findings show that improving market access, market information and collective action can strengthen growers' bargaining position. The study recommends price-risk mitigation, investment in storage and infrastructure, stronger market-information systems and buyer diversification, supported by digital market-information tools and farmer-producer organizations.

Keywords: Bargaining power, Mango growers, Ordinal logistic regression, Market information, Punjab

The Rise of the Product-Minded Project Manager: Bridging Regulatory Compliance and User Experience in FinTech

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Historically, the highly distinct professional disciplines of traditional project management and dynamic product management have operated in strict, fiercely independent organizational silos. However, within highly regulated, incredibly fast-paced global industries such as financial technology (FinTech) and digital healthcare, this rigid professional separation is rapidly dissolving. This incredibly timely research paper meticulously examines the massive global emergence of the "Product-Minded Project Manager, " a highly hybridized professional role that seamlessly blends strict traditional governance and rigorous schedule compliance with deep, user-centric product strategy. The primary academic objective of this extensive study is to accurately evaluate exactly how actively merging these two previously distinct skill sets directly impacts the ultimate commercial success and strict regulatory compliance of highly complex digital software launches. Utilizing a robust mixed-methods research design, the extensive study gathered highly detailed performance metrics and qualitative insights from sixty major FinTech project launches executed between early 2024 and late 2025. The extremely compelling analytical findings absolutely clearly demonstrate that digital projects led by explicitly product-minded project managers successfully achieved their critical strict regulatory compliance milestones twenty percent faster than purely traditional teams. Crucially, by actively integrating deep user experience (UX) feedback directly into the strict project execution lifecycle, these highly hybridized leaders successfully increased ultimate end-user adoption rates by a massive thirty-two percent. The abstract forcefully concludes that purely administrative project tracking is no longer sufficient; the modern project manager must be a deeply strategic product visionary to truly succeed.

Keywords: Project management, Product management, FinTech, Regulatory compliance, Hybrid roles

Human–AI Collaboration as a Bridge Between AI-Enabled HRM and Market Innovation: The Role of Employee Innovative Work Behavior and AI Literacy

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The rapid integration of artificial intelligence (AI) into organizational practices is reshaping human resource management, employee innovation and firms' ability to respond to evolving market needs. Despite increasing investment in AI-enabled HRM, limited research explains how these internal technological practices translate into market-oriented innovation. This study investigates the influence of AI-enabled HRM practices on market innovation through the sequential mediating roles of human–AI collaboration and employee innovative work behavior, while examining AI literacy as a moderating mechanism. Drawing on the Ability–Motivation–Opportunity framework and Resource-Based View, the study proposes that AI-enabled HRM practices enhance employees' ability to collaborate effectively with AI, enabling them to generate, promote and implement innovative ideas that ultimately contribute to market innovation. A quantitative, cross-sectional research design is proposed, with data to be collected from employees working in AI-adopting service-sector organizations in Pakistan. Structural equation modeling is employed to assess the proposed direct, sequential mediation and moderation relationships. The study finds that AI-enabled HRM practices positively influence human–AI collaboration and subsequently strengthen innovative work behavior and market innovation. Furthermore, AI literacy strengthens employees' ability to translate AI-enabled HR practices into productive human–AI collaboration. The study contributes to the emerging intersection of artificial intelligence, HRM, innovation and marketing by demonstrating how internally focused AI-enabled people-management practices can generate externally relevant market innovation. The proposed framework also offers practical insights for organizations seeking to develop AI-literate, innovation-oriented workforces capable of translating human–AI collaboration into sustainable customer and market value.

Keywords: AI-Enabled HRM, Human–AI collaboration, AI literacy, Innovative work behavior, Market innovation

Media Entrepreneurship in Pakistan: Analyzing Business Models of Digital Newsrooms and Independent Content Creators

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The speed of digital platform development has also fueled the adoption of a new concept of ‘Media Entrepreneurship' (Media-preneurship) in Pakistan as an alternative to mass media. The aim of this study is to explore the new business models, challenges and value creation of independent digital newsrooms, localized news producers and small digital marketing firms in the national entrepreneurial ecosystem. Structural problems in traditional media are countered by digital media entrepreneurs who are using YouTube, Facebook and specialized platforms for monetization to create viable businesses. This research looks at the revenue diversification strategies such as programmatic advertising, brand sponsorship, and affiliate marketing that are used by well-known Pakistani digital content creators and independent news outlets, using a qualitative multiple-case study method. Further, the paper discusses how these micro-enterprises create linkages with the industries as important marketing partners of local small and medium enterprises (SMEs). The preliminary results show that digital media entrepreneurs do make a significant contribution to the economy and to the visibility of companies in the region, but they also report on a number of challenges around platform policy changes, internet connectivity and the lack of formalized institutional support. In conclusion, this paper underscores the importance of media-preneurship in the current STEAM paradigm and reveals the role of creative arts and media communication in creating modern business innovations and linkages with the digital industry in Pakistan.

Keywords: Media entrepreneurship, Digital newsrooms, Content creators, Business models, Industry linkages



NEXT GENERATION EDU-TECH & ETHICS

ORAL PRESENTATIONS

Technology-Supported Assessment of Reading Comprehension in Primary Schools: A Descriptive Study of Class One, Three and Five Students in Shikarpur, Sindh, Pakistan

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Reading comprehension is a core skill that shapes children's success in all subjects, yet many primary students struggle to read fluently and understand what they read. Digital tools offer new ways to assess and support early reading, but they are rarely used in under-resourced primary schools. This descriptive study explored the reading comprehension of Class One, Class Three, and Class Five students in primary schools in Shikarpur, Sindh, Pakistan, and examined how technology can support reading assessment. Data were collected through structured reading sessions and tests of pronunciation, fluency, vocabulary, and comprehension. The sessions were recorded and timed using simple digital tools. Student performance was described using several measures: oral reading fluency (words correct per minute), reading accuracy, miscue analysis of pronunciation and reading errors, vocabulary scores, and literal and inferential comprehension scores. The findings show that students' fluency and accuracy improved and their reading errors decreased over repeated sessions, with differences across grade levels and reading components. Using several measures gave a fuller picture of each learner's strengths and weaknesses than fluency alone. The results suggest that digital tools, such as audio reading models, interactive reading applications, and instant feedback, can strengthen classroom instruction. The study also discusses ethical issues in using technology with young children, including equal access, data privacy, and informed consent. It concludes with recommendations for teachers and school leaders on the ethical and context-appropriate use of technology to improve reading comprehension in primary education.

Keywords: Reading comprehension, oral reading fluency, educational technology, descriptive research, primary education

Integrating YouTube Kids in Elementary Mathematics Instruction: A Mixed-Methods Investigation of Teachers' Perceptions, Pedagogical Strategies, and Barriers

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Effective educational technology policy and instructional leadership depend on understanding how teachers experience technology integration, as digital media become more available in primary education in developing countries. In basic mathematics classrooms, traditional methods such as chalk-and-talk still dominate. This lecture-based teaching keeps young students passive, as consumers of information and not active participants in conceptual reasoning. There is little empirical research on using accessible multimedia platforms, including customised YouTube video applications, to support active problem-solving in early mathematics. This study examined elementary mathematics teachers' perceptions, integration strategies, and barriers regarding the use of YouTube Kids in classrooms. An explanatory sequential mixed-methods design (Quan→Qual) was used. First, a quantitative survey was given to elementary mathematics teachers. Then, a purposively selected subsample took part in semi-structured interviews. The quantitative results show the main stages of integration, the operational challenges, and teachers' views on whether the application improves student engagement and conceptual understanding in specific mathematical areas. A qualitative thematic analysis then explained how teachers select, adapt, and scaffold video content, and which factors affect screening and classroom use. The results show how early mathematics education and visual digital tools interact, and they point to the need for carefully selected, curriculum-aligned video collections and focused professional development. Although YouTube Kids has great potential as an additional resource, its success requires active teacher mediation and not passive viewing. The study concludes with recommendations for school administrators to provide local content curation, offline digital archives, and professional development for mathematics teachers to support effective technology-assisted instruction.

Keywords: YouTube kids, Elementary mathematics, Digital pedagogy, Mixed-methods, Technology integration

Generative AI in Education: From Technological Innovation to Ethical Transformation

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Generative artificial intelligence (GenAI) is changing education by creating new ways of teaching, learning, assessment, feedback, content creation, and academic research. Tools that generate text, images, code, and other forms of content can personalise learning, support creativity, assist teachers, and improve access to educational resources. However, the use of GenAI also raises ethical challenges related to academic integrity, authorship, privacy, algorithmic bias, misinformation, transparency, digital inequality, and the possible loss of human judgement and learner autonomy. This paper critically examines the move from technological innovation to ethical transformation in education and proposes a human-centred approach to the responsible use of GenAI. It explores how educational institutions can go beyond seeing AI mainly as a productivity tool and develop policies and teaching practices based on fairness, accountability, inclusivity, transparency, and human agency. The paper gives special attention to AI literacy for both teachers and students, ethical AI-supported assessment, responsible use of generative tools in academic writing and feedback, and the protection of critical thinking and creativity. It argues that effective use of GenAI needs a balance between technological capability and educational values, so that AI supports teachers' professional judgement and students' intellectual engagement and does not replace them. It also suggests that ethical transformation should include institutional governance, continuous professional development, clear guidelines, and the development of students' critical digital citizenship. The paper concludes that the future of GenAI in education depends not only on technological progress, but also on how responsibly educators, institutions, and learners choose to use it effectively.

Keywords: Generative artificial intelligence, Human-centered education, Ethical transformation

Artificial Intelligence in STEM Education and Research: Next-Generation Educational Practices, Digital Competence, Innovation, and Ethical Responsibility

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Artificial intelligence (AI) is rapidly changing STEM education and research by changing how knowledge is created, taught, learned, assessed, and applied. AI-driven tools, such as generative AI, intelligent tutoring systems, learning analytics, simulation technologies, and AI research assistants, create new opportunities for personalised learning, interdisciplinary problem solving, scientific discovery, and educational innovation. However, effective use of AI requires more than access to technology. It requires a high level of digital competence, a critical understanding of AI, pedagogical readiness, and a strong sense of ethical responsibility. This conference paper discusses the role of AI in the next generation of STEM education and research. It focuses on new educational practices, the digital competence of learners and educators, and ethical issues in AI-enabled learning environments. It explores how AI affects adaptive and inclusive learning, real-time feedback, data-informed teaching, virtual experimentation, computational thinking, and collaborative research. The paper also outlines related concerns, including academic honesty, algorithmic bias, data protection, transparency, accountability, unequal access, overreliance on computational systems, and the responsible use of AI-generated content. It calls for a human-centred and ethically grounded vision of AI in STEM education, in which technology supports human judgement, creativity, and expertise and does not replace them. AI literacy should be promoted in educational institutions, together with policies that support responsible, transparent, and equitable use of AI. The paper concludes that sustainable use of AI in STEM education and research needs a careful balance between technological progress and educational quality, digital literacy, social justice, and ethics. This balanced approach can prepare students, teachers, and scientists to be active and responsible participants in an AI-powered world of science and education.

Keywords: Artificial Intelligence, STEM education, Digital competence, AI literacy, Ethical responsibility

Medical Students' Perceptions of Generative AI as a Replacement for Human Teachers: Feasibility, Dilemmas, and Replacement Intention

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The rapid development of generative artificial intelligence (AI) has started a debate on whether AI can replace human teachers in medical education. This question is now an urgent empirical issue, as AI enters the classroom and challenges traditional ideas of teaching, learning, and mentorship. This study investigates medical students' perceptions of generative AI as a possible replacement for traditional educators. It focuses on the relationships among feasibility, dilemmas, perception, and replacement intention. Data were collected from 579 medical students using a structured questionnaire and analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) in SmartPLS. The measurement model showed strong reliability and validity for all constructs. The structural analysis showed that feasibility significantly influenced both perception ($\beta = 0.295$, $p < 0.001$) and replacement intention ($\beta = 0.137$, $p < 0.001$). Perception strongly predicted replacement intention ($\beta = 0.314$, $p < 0.001$) and mediated the relationship between feasibility and replacement intention ($\beta = 0.093$). However, dilemmas did not moderate the link between feasibility and perception ($\beta = 0.045$, $p = 0.250$). This suggests that ethical or professional concerns had little influence on students' acceptance of AI teaching. Importance-Performance Map Analysis (IPMA) also identified perception as the most influential construct driving replacement intention. The findings are based on the Technology Acceptance Model (TAM) and Expectation-Confirmation Theory (ECT). They suggest that medical students' acceptance of AI in education is shaped more by practical feasibility and positive perception than by moral concerns. The study concludes that AI cannot yet replace the human teacher, but its perceived feasibility and usefulness make it a powerful complementary tool for the future of medical education.

Keywords: Generative ai, technology acceptance model, Expectation-confirmation theory, Feasibility, Ethical dilemmas

Beyond Academic Performance: Measuring Ethical Health and Integrity in AI-Driven Universities

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Artificial intelligence (AI) is rapidly changing the main functions of universities, including teaching, assessment, research, student support, administration, and decision-making. However, university performance is still judged mainly by traditional indicators such as academic achievement, research output, employability, rankings, and finances. These indicators show what universities achieve, but they say little about how ethically, fairly, and transparently these results are produced. Recent international reports show that this concern is urgent. UNESCO's Higher Education Global Trends Report (2026) identifies technological disruption as a major force in higher education. OECD's Trends Shaping Education 2025 treats AI as an influence across all areas of education. The United Nations report Governing AI for Humanity (2024) calls for inclusive, accountable, and human-rights-based AI governance. Against this background, this conceptual paper proposes an Ethical Health and Integrity Index (EHII) as a complementary framework for assessing the ethical condition of AI-driven universities. Ethical health is defined as an institution's ability to ensure that its policies, technologies, decisions, academic practices, and culture support integrity, human dignity, fairness, accountability, transparency, privacy, human agency, and social responsibility. The EHII has eight connected domains: academic and assessment integrity; research integrity; responsible AI governance; fairness and protection from algorithmic discrimination; privacy and data governance; transparency and explainability; human oversight and agency; and ethical culture and well-being. Each domain can be measured using indicators from policy evidence, institutional practices, stakeholder perceptions, incident data, and compliance mechanisms. The paper argues for a move from performance-centred evaluation to a performance-with-integrity approach, in which ethical health is a measurable part of university quality and not only a matter of compliance. The EHII can help universities, quality assurance bodies, accreditation agencies, and policymakers in ethical benchmarking, self-assessment, risk identification, and continuous improvement.

Keywords: Ethical health, Institutional integrity, Artificial intelligence, Higher education, AI governance

From Rote to Chatbot: Leveraging ChatGPT-Assisted Learning to Enhance Vocabulary Acquisition among Year 3 Primary School ESL Pupils in Pokok Sena, Malaysia

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Vocabulary development is a basic building block of linguistic proficiency. However, many Malaysian primary pupils have weak vocabulary because of teaching practices that lack context, such as rote memorisation. This quasi-experimental study aims to examine the effect of ChatGPT-assisted learning on vocabulary size, retention, and productive knowledge among Year 3 pupils in Pokok Sena, Malaysia. The study is based on Vygotsky's Sociocultural Theory and Mayer's Cognitive Theory of Multimedia Learning. It treats ChatGPT as a "Digital More Knowledgeable Other" (MKO) that gives personalised support within the learner's Zone of Proximal Development (ZPD). A purposive sample of 40 pupils will take part in an eight-week intervention. The pupils will be randomly assigned to an experimental group (N = 20), which receives chatbot-assisted instruction, and a control group (N = 20), which receives traditional teacher-led instruction. Data will be collected using several methods: the computer-Adaptive Test of Size and Strength (CATSS), a criterion-referenced Vocabulary Knowledge Test (VKT), the Foreign Language Learning Boredom Scale (FLLBS), and semi-structured interviews. Independent samples t-tests and ANCOVA will be used to analyse the quantitative data and measure vocabulary gains. The study expects a significant improvement in overall vocabulary mastery, with the largest benefits in productive use and long-term retention. It also expects that the intervention will reduce boredom in foreign language learning by providing a low-anxiety and interactive practice environment. The study intends to develop a new teaching approach for using generative AI in the Malaysian primary curriculum and to reduce the "context gap" in traditional education.

Keywords: ChatGPT-assisted learning, Vocabulary acquisition, Generative AI in education, Primary ESL learners, Sociocultural theory

Exploring E-Learning across Generations: A Comprehensive Literature Review of E-Learning (1924-2024)

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This study examines the evolution of e-learning, including its history, underlying theories, and the technologies that continue to change it across generations. E-learning has made education more flexible, accessible, and personalized and has reached learners worldwide. However, generations experience it differently, because differences in technological fluency, learning styles, and cultural background affect how each group adopts and benefits from digital learning platforms. The review focuses on how Traditionalists, Baby Boomers, Generation X, Millennials, Generation Z, and Generation Alpha engage with e-learning. A qualitative approach was used, drawing on journal articles, books, and credible reports published up to 2024. Purposive sampling was used to select studies that specifically examine generational differences in adoption, barriers, and preferences. The study is based on constructivist learning theory, which holds that learners actively shape their own experiences through the tools and technologies available to them. It also uses behaviorism and connectivism to explain how e-learning systems are designed and used. In addition, it explores how emerging technologies, including Artificial Intelligence (AI), Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR), and mobile learning, are changing educational practice. Together, these insights give a broad view of the opportunities and challenges that e-learning brings in a time of rapid generational and technological change. By synthesizing existing research, the review highlights the barriers and preferences that shape e-learning across age groups and offers practical recommendations. Its aim is to help educators, policymakers, and platform designers improve e-learning to meet the needs of learners of every generation.

Keywords: E-learning, Theoretical foundations, Emerging technologies, Generational shifts, Learning preferences



NEXT GENERATION EDU-TECH & ETHICS

POSTER

PRESENTATIONS

Explainable AI-Driven Adaptive Learning for Future-Ready STEAM Education: A Personalized and Trustworthy Learning Analytics Framework

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Artificial intelligence (AI) is changing education by supporting personalised learning, early identification of academic difficulties, and data-driven teaching support. However, many existing intelligent learning systems use black-box prediction models. These models make it hard for teachers to understand why a student is classified as at risk, and this reduces trust in AI-supported decisions. This study proposes an Explainable AI-Driven Adaptive Learning Framework (XAI-ALF) for future-ready STEAM education. The framework combines student performance prediction, explainable AI, and personalised intervention recommendations within a unified architecture. Academic records, assessment performance, learning engagement, and digital interaction patterns are used to identify students who may need extra academic support. Machine learning algorithms, including Logistic Regression, Random Forest, XGBoost, and Artificial Neural Networks, are compared using accuracy, precision, recall, F1-score, and area under the ROC curve. SHapley Additive exPlanations (SHAP) are also used to identify the factors behind individual predictions and give teachers clear evidence for decision-making. Beyond predictive performance, the approach emphasises transparency, fairness, learner support, and responsible use of AI. The study aims to show how explainable and adaptive AI can move learning analytics from simple performance prediction to practical, human-centred decision support. In this way, it contributes to intelligent learning, digital transformation, and the development of future-ready STEAM skills.

Keywords: Explainable AI, adaptive learning, learning analytics, personalized education, steam education

Generative AI in Education: Balancing Innovation, Academic Integrity, and Ethical Responsibility

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This study investigates the growing use of generative artificial intelligence (AI) tools in education and examines how innovation can be combined with ethical principles to protect academic integrity and responsible learning. It aims to understand how generative AI tools are adopted, to identify the ethical challenges of AI-assisted learning, and to explore strategies for responsible AI use among high school students and teachers in Islamabad. A quantitative cross-sectional survey design based on the positivist research philosophy was used. The population was all public and private high schools in Islamabad Capital Territory, about 400 schools with nearly 150,000 students. A sample of 384 respondents was selected through proportionate stratified random sampling to represent different categories of high schools. Data were collected using a structured questionnaire adapted from validated instruments that measure generative AI use, academic integrity, ethical awareness, and responsible technology practices. Reliability was confirmed by Cronbach's alpha values above the acceptable level of 0.70. Content validity was established through expert evaluation, and construct validity was confirmed through factor analysis. The findings showed that students increasingly used generative AI tools for academic support, information retrieval, and content generation. However, limited ethical awareness raised concerns about academic dishonesty, overdependence on AI-generated answers, and responsible technology use. The study recommends AI literacy programmes, ethical guidelines for AI use in schools, teacher training on responsible AI integration, and greater awareness of academic integrity among students. It provides empirical evidence to help educators, policymakers, and school administrators develop ethical and sustainable approaches to using generative AI in education.

Keywords: Generative artificial intelligence, Educational technology, AI ethics

Responsible Generative AI in University Learning: Psychological Well-Being, Self-Efficacy, and Ethical Challenges in Future-Ready Higher Education

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Generative artificial intelligence (GenAI) is changing how university students find information, solve problems, generate ideas, and complete academic tasks. This pilot study examined responsible GenAI use, academic self-efficacy, psychological well-being, ethical awareness, perceived academic benefits, and AI over-reliance among university students. A cross-sectional survey was conducted using a researcher-developed questionnaire with five-point Likert items and questions on GenAI use, institutional guidance, and responsible practices. Twenty-one responses were received, and the analysis was limited to 16 respondents who confirmed that they were currently enrolled university students. Participants came from different disciplines and from both public and private universities. Among eligible participants, 93.8% reported previous GenAI use. Mean scores were 4.23 out of 5 for ethical awareness, 4.07 for academic self-efficacy, 4.05 for perceived academic benefits, 3.92 for psychological well-being, 3.58 for responsible AI use, and 3.66 for AI over-reliance. Only 25% reported that their university gave clear guidance on academic GenAI use, while 68.8% believed that students should receive formal training in responsible GenAI use. Open-ended responses stressed clear institutional policies, AI literacy training, disclosure of AI use, originality, independent thinking, and using GenAI as a learning aid and not as a replacement for students' own reasoning. These preliminary findings suggest that responsible use of GenAI requires ethical awareness, institutional guidance, and learning practices that protect students' independent thinking. The findings should be interpreted with caution because of the small pilot sample and the researcher-developed instrument. Future research should use larger and more diverse samples and validated measures to examine the relationships among GenAI use, self-efficacy, well-being, and academic integrity.

Keywords: Generative artificial intelligence, Psychological well-being, Self-efficacy, responsible AI, Higher education

Relationship of Educational Technology Integration with Job Satisfaction and Work Performance of Primary School Teachers

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Globally, the quality of primary education depends on the well-being, professional competence, and performance of teachers. Teachers are directly responsible for developing students' problem-solving, critical thinking, creativity, decision-making, communication, and socio-emotional skills, as well as the academic growth of early learners. This study examined the relationship between educational technology integration and the job satisfaction and work performance of primary school teachers in public schools of Faisalabad District, using a correlational research design. The population was all primary school teachers in public primary schools of the division, and a sample of 250 teachers was selected through simple random sampling. Data were collected with a structured five-point Likert-scale questionnaire that measured level of satisfaction, level of performance, and level of effectiveness. Expert opinion confirmed the validity of the instrument, and a pilot study established its reliability (Cronbach's $\alpha = .86$). Data were gathered online through Google Forms and through the researcher's personal visits to public primary schools. They were analyzed in SPSS using descriptive and inferential (correlation) statistics. The results showed a statistically significant positive relationship between educational technology integration and teachers' job satisfaction ($r = .269$, $p < .001$) and work performance ($r = .234$, $p < .001$). The study concludes that greater use of educational technology in classroom practice is associated with higher job satisfaction and better work performance among primary school teachers. These findings highlight the need for adequate digital infrastructure, continuous professional training, and supportive school policies to strengthen technology use in public primary schools.

Keywords: Educational technology integration, Job satisfaction, Work performance, Primary school teachers, Faisalabad division

STEAM Education: Reimagining Teacher Professionalism through NPST for 21st-Century Learning in Pakistan

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In Pakistan, the National Professional Standards for Teachers (NPST) guide teacher professionalism in the 21st century and support Science, Technology, Engineering, Arts and Mathematics (STEAM) education through interdisciplinary learning, inquiry-based instruction, technology integration, and the use of knowledge in real-life situations. This study compared institutional and leadership support, challenges, and improvement strategies related to NPST implementation in Catholic and public secondary schools in Faisalabad District, with attention to teaching practices that support STEAM. A descriptive research design was used, and data were collected through a structured questionnaire from 450 teachers. Teachers generally rated school leadership support for NPST implementation as high ($M = 3.93$, $SD = 0.58$). Catholic schools showed significantly higher leadership support ($M = 4.13$, $SD = 0.53$) than public schools ($M = 3.73$, $SD = 0.61$), $t = 7.12$, $p < .001$. Teachers also reported substantial challenges in implementing NPST (overall $M = 3.99$, $SD = 0.56$). Large class size, limited professional training, and inadequate ICT resources were the most serious barriers. Public school teachers faced significantly greater challenges than Catholic school teachers ($t = -9.21$, $p < .001$). These barriers may limit technology-based STEAM practices, which require teachers to combine digital technologies with interdisciplinary content and to develop students' communication, collaboration, and problem-solving skills. Respondents strongly supported subject-based teacher training, more ICT facilities, and improved assessment policies. These strategies can strengthen teachers' capacity by linking NPST with STEM disciplines and innovative assessment approaches. The study concludes that school leadership and institutional support play a decisive role in implementing NPST and in creating conditions for STEAM teaching. Context-sensitive policy interventions are recommended to promote fair, innovative, and sustainable NPST implementation in both school systems.

Keywords: STEAM education, NPST, Catholic and public schools, Secondary education

Multi-Grade Teaching for Next-Generation

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Education strengthens human and national development, with instructional quality in schools especially at the primary level in shaping lifelong learning outcomes. However, rural and remote schools face persistent challenges such as limited resources, weak infrastructure, teacher shortages, and low enrollment. These conditions often force schools into multi-grade teaching, where one teacher manages multiple grade levels simultaneously in a single classroom. Despite its widespread practice, the actual effectiveness of this approach in achieving learning outcomes remains underexplored, particularly in the context of Pakistan's rural education landscape. This study examined multi-grade teaching strategies to improve learning outcomes for next generation education by investigating how multi-grade instructional strategies influence students' cognitive, effective, and psychomotor development by adopting a quantitative research design. The research focused on public primary school teachers engaged in multi-grade teaching across the Faisalabad District. A total sample of 240 respondents was selected using a simple random sampling technique. A structured questionnaire was adapted and developed from existing literature. The content validity of questionnaire was established through expert review and reliability confirmed through a pilot study (Cronbach's Alpha = 0.84). The data gathered were analyzed by utilizing descriptive and inferential statistics. Data were collected through both personal visits and online Google forms, then analyzed using SPSS for quantitative data responses. Findings revealed that multi-grade teachers relied most heavily on technology integration (M =3.46, SD =1.14) activity-based learning (M =3.44, SD =1.18) and collaborative learning (M =3.43, SD =1.12) while strategies such as real-life examples (M = 3.25, SD = 1.20) were employed only moderately. Overall, results indicated three teaching strategies, including activity-based learning, collaborative learning, and technology integration, achieved higher means than the others strategies, which revealed that multi-grade teachers used these strategies at a higher level, while real-life examples were used at a moderate level in order to develop students' learning outcomes, highlighting the need for enhanced teacher training and resource support.

Keywords: Multi-grade teaching, Next generation, Activity-based learning, Collaborative learning, Technology integration

Digital Competence and Student Learning Outcomes in Higher Education

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As universities use digital technologies more widely for teaching and learning, digital competence has become increasingly important in higher education. This study examined the relationship between digital competence and student learning outcomes, particularly learning autonomy and academic engagement. A quantitative research approach with a correlational design was used. Data were collected from university students through a structured questionnaire that measured digital competence, learning autonomy, and academic engagement. Descriptive statistics were used to summarize the study variables, and Pearson correlation was used to examine the relationships among them. The results showed that digital competence was significantly related to students' learning autonomy and academic engagement. Students with higher digital competence tended to show greater learning autonomy and academic engagement. The findings show that digital competence is an important factor related to students' learning experiences and engagement in higher education. Higher education institutions are recommended to strengthen students' digital skills through hands-on training, technology-integrated learning experiences, and ongoing support for the effective use of digital learning tools.

Keywords: Digital competence, Learning autonomy, Academic engagement, Higher education, Educational technology

The Impact of Digital Learning Tools on Academic Performance of Secondary School Students in Public Schools of Faisalabad

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Digital learning tools have become increasingly important in secondary education. They give students access to educational applications, online learning platforms, multimedia resources, educational videos, and digital assessment tools. However, there is limited evidence on the relationship between digital learning tools and academic performance in public secondary schools in Faisalabad. This study examines the use of digital learning tools and their relationship with the perceived academic performance of secondary school students in public schools of Faisalabad. A quantitative descriptive survey design was used, and a structured questionnaire was given to 132 secondary school students. The questionnaire measured students' use and perceptions of digital learning tools and their perceived academic performance using a five-point Likert scale. Descriptive statistics and regression analysis were used to analyze the data. The findings showed moderately positive perceptions of digital learning tools, with educational videos, online learning platforms, and educational applications receiving higher ratings. Smartphone access was more common than computer access among the respondents. Regression analysis showed that digital learning tools significantly predicted perceived academic performance ($\beta = .507$, $p < .001$), and the model explained 25.7% of the variance in academic performance ($R^2 = .257$). The findings suggest a positive association between the use of digital learning tools and students perceived academic outcomes, particularly in lesson understanding and examination performance. The study also highlights the importance of adequate digital infrastructure, teacher digital competence, and equal access to technology for effective technology-assisted learning. These findings provide context-specific evidence that can support efforts to strengthen digital learning in public secondary schools in Faisalabad.

Keywords: Digital learning tools, Academic performance, Secondary education, educational technology, Faisalabad

Impact of Generative AI Literacy on Students' Future Readiness in Higher Education

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The purpose of this study was to examine the role of generative artificial intelligence (AI) literacy in preparing students for the future in higher education. Students' career readiness, learning adaptability, and digital competence were measured after a generative AI literacy program. The study used a descriptive correlational design and a quantitative method. Survey data were collected from students of higher education institutions using a structured questionnaire. The data were analyzed using descriptive statistics, Pearson correlation, and simple linear regression. There was a positive and significant correlation between digital competence and students' competence in using generative AI. The relationship between generative AI literacy and career readiness was also significant and could be linear or non-linear, which suggests that students with strong generative AI knowledge are more likely to be career-ready in workplaces that increasingly rely on generative AI. Likewise, there was a significant positive correlation between generative AI literacy and learning adaptability, which means that students who are more familiar with generative AI are more likely to adapt to new learning technologies and changing requirements. Overall, the results suggest that generative AI literacy is a significant variable related to several aspects of students' readiness in higher education. Based on these results, the author recommends that higher education institutions include generative AI literacy in academic courses, offer hands-on generative AI training, and create activities that promote students' responsible and effective use of AI. Faculty development and institutional policies on the ethical use of AI are also needed to strengthen students' digital, career, and adaptive learning skills.

Keywords: Generative AI literacy, Digital competency, Adaptability in learning

University Students' Engagement with STEM Learning: A Comparative Analysis by Gender and Academic Discipline

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Student engagement is an important factor for effective learning and participation in Science, Technology, Engineering, and Mathematics (STEM) education. This study aimed to compare STEM learning engagement between male and female university students and among students in different academic disciplines. A quantitative comparative research design was used. Data were collected from university students using an adapted STEM learning engagement questionnaire. The data were analyzed using descriptive statistics, an independent-samples t-test, and one-way ANOVA. The findings showed that university students' STEM learning engagement was moderate to high. The independent-samples t-test showed a statistically significant gender difference, $t(198) = 2.41$, $p = .017$, with higher engagement among female students than male students. The one-way ANOVA also showed a statistically significant difference between academic disciplines, $F(3, 196) = 4.87$, $p = .003$. These results indicate that students' engagement differs by gender and by discipline. The study recommends that universities adopt an inclusive, student-centered, and interactive STEM teaching model that considers the needs of different groups of learners. Faculty should encourage collaborative and hands-on learning activities to deepen students' engagement with the subject.

Keywords: STEM learning, Student engagement, Academic discipline

An Analysis of ICT Laboratories Established by the Government of Punjab in Secondary Schools of District Faisalabad

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The aim of this study was to analyze the Information and Communication Technology (ICT) laboratories established by the Government of Punjab in secondary schools in district Faisalabad. The population was all head teachers, secondary school IT teachers, and students of classes 9 and 10 in district Faisalabad. A sample of 576 respondents (8 head teachers, 8 IT teachers, and 80 students from a selected school in each of City Faisalabad, Sadar Faisalabad, Chak Jhumra, Jaranwala, Tandlianwala, and Samundri) was selected through random sampling. Data were collected using two questionnaires and one checklist. Percentages, means, and standard deviations were calculated using SPSS. The results indicated that the Government of Punjab provided 100% of the facilities in the IT labs, but they were not functioning properly. In the sampled schools, 81% of desktop computers were functional, 86.5% of schools had printers in working condition, 69% had scanners, only 38% had working software, 88.9% had internet facility, and 74.4% had UPS in working condition. Also, 65% of schools had a sufficient budget for computer maintenance, while only 7% had lab assistants. The study recommends that the government provide computers according to the number of students, provide a suitable budget for maintaining ICT labs, ensure an uninterrupted power supply, appoint proper lab assistants to maintain equipment, and provide DSL connections to ICT labs in secondary schools of Faisalabad District. Heads and teachers of the schools should also ensure that students can access the computer labs whenever they need them for learning.

Keywords: ICT labs, Facilities, Secondary school, Faisalabad

Digital Transformation and the Development of 21st-Century Skills through STEAM Education

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Digital transformation is an important part of higher education today and plays a significant role in designing learning, communication, and problem-solving in different disciplines. In this changing context, science, technology, engineering, arts, and mathematics (STEAM) education offers a multidisciplinary approach to the skills needed to meet the growing demands of technological environments. This study analyzed the connection between digital transformation and the development of 21st-century skills in higher education, based on STEAM education. A quantitative research approach with a cross-sectional survey design was used. A questionnaire was given to higher education students to collect data on digital transformation and 21st-century skills, such as critical thinking, creativity, innovation, and digital literacy. Digital transformation was summarized using descriptive statistics, and Pearson correlation and regression analyses were used to examine the relationship between digital transformation and students' 21st-century skills. The results showed that digital transformation is positively related to the development of students' 21st-century skills. Students with higher levels of digital technology integration in STEAM-based learning had stronger skills in critical thinking, creativity, innovation, and digital literacy. The results also showed that digital transformation had a substantial effect on these skills, which confirms the importance of interdisciplinary, technology-supported learning in preparing students for 21st-century higher education. The study finds that implementing STEAM education improved students' ability to solve complex problems and use digital technology properly. The findings are relevant to university teachers, curriculum developers, educational leaders, and university policy makers who want to strengthen technology-integrated, competency-based approaches in higher education.

Keywords: Digital transformation, STEAM education, 21st-century skills, Higher education, Digital literacy

STEAM Readiness among University Students across Different Academic Disciplines

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Scientific, technological, and innovation developments in a fast-changing world require university students to learn skills for working across disciplines. STEAM education is an integrated approach that links science, technology, engineering, arts, and mathematics with future-ready skills and applications. This study examined the STEAM readiness of university students across academic disciplines, focusing on STEAM technology readiness, innovation readiness, and career readiness. A quantitative approach with a cross-sectional comparative survey design was used. A structured questionnaire was developed to collect data from university students of different academic disciplines on technology readiness, innovation readiness, and career readiness. One-way analysis of variance (ANOVA) was used to find significant differences among students by academic discipline in the three areas of STEAM readiness. The results showed significant differences between academic disciplines in technology readiness, innovation readiness, and career readiness. This means that students' preparedness for technology-integrated, innovative, and career-oriented learning was not the same across disciplines. The results show the importance of considering disciplinary differences when designing STEAM learning experiences in higher education. The findings also indicate that students with different academic experiences may need discipline-specific experiences to develop technological skills, build creative thinking, and prepare for their next steps in life. The study concludes that a multidisciplinary approach to measuring STEAM readiness can provide useful evidence to support STEAM education strategies. Universities can use this evidence to create learning environments that improve graduates' technology readiness, promote innovation, and prepare them for future academic and professional requirements.

Keywords: STEAM readiness, University students, Technology readiness, Innovation readiness, Career readiness

Cybercrime, Youth, and Digital Vulnerability in Series Pritam and Pedro (2026)

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Technology is spreading quickly in the modern era, and young people use it more and more. They interact with technology through social media, digital platforms, gaming, and digital innovations. This study describes young people's vulnerability to online threats, especially hacking, digital exploitation, and unsafe online interactions. It analyzes the web series Pritam and Pedro (2026) through the lens of Cyber Routine Activity Theory (CRAT). The theory involves three elements: a motivated offender (the person who commits the crime), a suitable target (the offender's victim), and inadequate guardianship (the lack of effective safeguards to stop the offender). The study examines dialogues, specific scenes, and online activities from the series. Using qualitative textual analysis, it examines how the everyday digital interactions of a vulnerable person can create opportunities for an offender. Risky digital practices and limited safety measures can increase vulnerability to cybercrime. The study highlights how young people's online interactions, digital dependency, and exposure to virtual spaces may increase their vulnerability to cyber threats. The analysis shows that limited digital understanding, weak parental monitoring, and few safety measures can make young users more exposed to online risks. The study concludes that Pritam and Pedro (2026) presents digital spaces as environments where everyday online activities can create opportunities for cybercrime and increase youth vulnerability. It highlights the importance of digital literacy, parental supervision, cyber awareness, and the ethical use of technology.

Keywords: Cybercrime, Cyber routine activity theory, Youth digital vulnerability, Digital safety

Artificial Intelligence and Students' Critical Thinking Skills

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Artificial intelligence (AI) is increasingly used in education and offers students new opportunities for learning, information processing, and academic support. However, its growing use may also affect students' ability to think critically, analyze information, evaluate evidence, and form independent judgments. This study investigated the relationship between AI use and critical thinking skills among undergraduate students. A quantitative, cross-sectional correlational design was used. The population was BS students at GC University Faisalabad, and a sample of 100 students was selected through stratified random sampling. Data were collected using a structured questionnaire that measured the frequency and patterns of AI use for academic purposes, together with a critical thinking scale. Content validity was established through expert review, and reliability was assessed using Cronbach's alpha ($\alpha = .83$). The data were analyzed using descriptive statistics, Pearson correlation, and simple linear regression. Ethical principles, including informed consent, voluntary participation, confidentiality, and anonymity, were followed. The findings showed a statistically significant positive relationship between AI use and students' critical thinking skills ($r = .65$, $p < .001$), and AI use significantly predicted students' critical thinking. These findings suggest that purposeful use of AI may support critical thinking in higher education. Universities are therefore recommended to develop clear guidelines for responsible AI use and to design assignments that encourage analysis and independent reasoning.

Keywords: Artificial intelligence, Critical thinking skills, BS students, Higher education, Faisalabad

Effects of Social Media Platforms on the Academic Motivation, Research Skills, and Academic Performance of University Students

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Social media platforms play an important role in leisure, entertainment, and learning. This study investigated the effects of social media platforms (SMPs) on students' academic motivation, research skills, and academic performance, using a descriptive and correlational research approach. The population was students of general universities in Punjab Province, Pakistan. A sample of 504 students was selected through simple random sampling. Based on previous literature, a structured questionnaire with a five-point Likert scale was developed and used for data collection after its reliability and validity were confirmed. The researcher collected data online (Google Form) and in person at the sampled universities. The data were analysed in SPSS using descriptive and inferential statistics to answer the research objectives. The results showed a moderate positive relationship between social media platforms and students' academic motivation. They showed a high positive relationship between social media platforms and students' research skills and academic performance. It is recommended that, to improve students' learning, teachers encourage students to use social media platforms for academic purposes as well as for entertainment.

Keywords: Social media platforms, Academic motivation, Research skills, Academic performance

National Professional Standards for Teaching Next-Generation

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This study evaluated the effectiveness of the National Professional Standards for Teachers (NPST) in Pakistan for teaching the next generation, using a descriptive research method. The population was all secondary school teachers in Faisalabad Division, and the sample was 600 teachers. An adapted five-point Likert-scale questionnaire with 40 positive statements was used for data collection, after its validity and reliability were confirmed. The researcher collected all the data, and it was analyzed in SPSS using descriptive statistics to assess teachers' level of agreement with the study variables. The results showed that secondary school teachers had high levels of awareness and understanding of NPST. Teachers strongly agreed that NPST is effective for their teaching practices, professional development, and students' learning outcomes. The results also showed that there are several obstacles to implementing NPST in the school education department. The study recommends that the concerned authorities provide more training on NPST and its proper implementation, and that the obstacles be removed for effective implementation of NPST in the school education department.

Keywords: Effectiveness, National professional standards, Teachers, School education

Impact of Transformational Leadership on Teacher Performance in STEAM Education

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Teaching Science, Technology, Engineering, Arts, and Mathematics (STEAM) together requires creative methods, modern tools, and strong guidance from school leaders. This study explores how transformational leadership, in which leaders inspire, support, and encourage new ideas, helps teachers perform better in STEAM classrooms. A survey was given to teachers and school heads in schools that implement STEAM activities. The survey measured how leaders guide and support their staff, and how well teachers plan lessons, use technology, and engage students in interdisciplinary activities. The findings show a strong positive relationship between supportive leadership and teacher performance. When leaders motivate their staff and encourage creative problem-solving, teachers feel more confident in using modern teaching tools and designing hands-on STEAM projects. This supportive environment also helps teachers overcome the challenges of changing traditional teaching practices. Overall, the study shows that when school leaders give inspiring and supportive guidance, teachers perform better, stay motivated, and deliver higher-quality STEAM education to their students.

Keywords: Transformational leadership, Teacher performance, STEAM education, School motivation

Applying Behavioral Economics and Reference Class Forecasting to Eliminate Optimism Bias in Project Cost Estimations

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Complex projects often suffer large cost overruns and serious schedule delays, and these problems cannot be explained only by poor technical planning or unforeseen external events. Research increasingly points to psychological factors, mainly optimism bias and deliberate strategic misrepresentation, as key causes of repeated project failure. This paper investigates how behavioral economics can be applied to project cost estimation and schedule baseline development in project management. The objective was to evaluate how effective reference class forecasting and structured behavioral de-biasing techniques are in improving the accuracy of initial project funding estimates. A quasi-experimental design was used to analyze the estimation accuracy of two groups of project planners working on complex public sector infrastructure projects over a two-year period. The control group used traditional bottom-up estimation techniques. The experimental group was trained in reference class forecasting, a method in which planners base their baseline estimates on the actual historical outcomes of similar past projects and not on subjective predictions about the future. The findings show that reference class forecasting reduced the average cost estimation error from forty percent to twelve percent. In addition, psychological safety workshops, which encourage honest and penalty-free internal risk reporting, significantly reduced deliberate strategic misrepresentation by project sponsors who wanted to secure initial funding. Despite these improvements, the study found strong institutional resistance at the executive level. It concludes that solving the problem of inaccurate project estimation requires a firm institutional commitment to behavioral economics.

Keywords: Project management, Behavioral economics, Optimism bias, Forecasting, cost estimation

Artificial Intelligence in Modern Education: Opportunities and Ethical Challenges

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Artificial intelligence (AI) is rapidly changing how we learn and gain knowledge. In modern classrooms, it helps students learn at their own pace, saves teachers valuable time on repetitive paperwork, and makes quality education more accessible to people everywhere. As schools adopt these digital tools, it is increasingly important to assess how AI affects learning outcomes. However, the wide use of AI also brings serious ethical and operational problems. These include risks to data privacy, unfair algorithmic decisions, academic dishonesty, and less meaningful human interaction between teachers and students. Current research often focuses only on technological benefits, and little is known about how to balance technical innovation with ethical safeguards in academic settings. This study addresses this gap by analyzing current AI educational applications and reviewing emerging ethical frameworks across modern academic systems. The findings indicate that AI improves student engagement and makes administrative work more efficient. However, unguided use of AI risks deepening educational inequalities and weakening academic integrity. Without strict regulatory standards and careful ethical oversight, automated systems may reinforce learning biases and put student data security at risk. AI should therefore be used as a supportive tool that strengthens human teaching and does not replace it. Educational institutions should establish clear ethical policies, promote AI literacy among educators, and put balanced governance frameworks in place to create an inclusive, equitable, and responsible learning environment for future generations.

Keywords: Artificial intelligence, Modern education, Ethical challenges, Data privacy, Academic integrity

Effect of Heads' Distributed Leadership on Organizational Commitment of Teachers at Secondary Level

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This study examined the influence of school heads' distributed leadership on the organizational commitment of secondary school teachers. Its objectives were to find the extent of heads' distributed leadership, to find the extent of teachers' organizational commitment, to determine the impact of distributed leadership on teachers' organizational commitment, and to develop a distributed leadership model for strengthening it. A sequential explanatory mixed-methods design was used. The quantitative phase was followed by a qualitative phase to obtain statistical evidence and a deeper understanding. The respondents were teachers and administrators of public and private secondary schools in Faisalabad Division, Punjab, Pakistan. The sample was 800 teachers and 200 administrators. For the qualitative phase, 25 teachers and 25 administrators were selected purposively until data saturation. Data were collected using a five-point Likert scale questionnaire and a semi-structured interview protocol. The Distributed Leadership Scale covered influence and school structure, strategic vision, values and beliefs, collaboration and cooperation, decision making, responsibility and accountability, and initiatives. The quantitative data were analyzed using frequencies, percentages, mean, standard deviation, t-test, ANOVA, correlation, and regression analysis. The qualitative data were analyzed through thematic analysis. The results showed that both distributed leadership and organizational commitment were high. Normative commitment was the strongest dimension of organizational commitment, followed by affective and continuance commitment. Correlation and regression results showed that heads' distributed leadership had a significant positive impact on teachers' organizational commitment. The qualitative results supported the quantitative results and showed that teacher participation, trust, collaboration, empowerment, and fair delegation increased teachers' loyalty and emotional attachment. Overall, distributed leadership is a leadership approach that can help improve teachers' organizational commitment in secondary schools.

Keywords: Distributed leadership, Organizational commitment, Secondary school level

The Impact of Organizational Culture on Students' Personality Development in the Era of Artificial Intelligence

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This study examined the impact of organizational culture on the personality development of students in the era of artificial intelligence. A quantitative approach was used. The population was Grade 10 students and the heads of secondary schools. A sample of 1971 students and 60 heads was taken from district Faisalabad. Data were collected from students and heads through questionnaires. The validity of the instruments was confirmed through expert opinion, and reliability was checked using Cronbach's alpha. The data were analyzed using descriptive statistics (mean, standard deviation, and percentage) to examine the relationship between organizational culture (independent variable) and personality development (dependent variable). A t-test was also used to compare groups by gender and school location. The results showed a significant relationship between organizational culture and students' personality development in the context of artificial intelligence. The study recommends that school heads develop an organizational culture in their schools that responds to the current trend of artificial intelligence.

Keywords: Organizational culture, Personality development, Artificial intelligence

Evaluating ICT Integration in Secondary Schools: Infrastructure, Teacher Competence, and Student Access in the Era of Next-Generation Edu-Tech

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This study examined the status of Information and Communication Technology (ICT) integration in secondary schools in Faisalabad Division. It focused on teacher competence, infrastructure, and student access to ICT resources in the era of next-generation Edu-Tech. ICT plays an important role in modern education by improving teaching, increasing student engagement, and raising academic achievement. However, ICT integration differs among schools because of differences in technological resources, infrastructure, and teachers' professional skills. A total of 544 teachers from public high and higher secondary schools in Faisalabad Division were selected through simple random sampling. The findings showed that all study variables were statistically significant ($p \leq .001$), which indicates positive teacher perceptions of ICT availability and access. About 62.5% of teachers strongly agreed that their schools provided ICT devices, and 64.3% strongly agreed that students had opportunities to use these technologies. The mean score for ICT availability was 3.56 (SD = 0.94), which shows an overall positive perception. Despite these encouraging results, challenges such as inadequate infrastructure, limited teacher training, and unequal student access still limit effective ICT integration. The study recommends more investment in educational technology, continuous professional development for teachers, and equal access to ICT resources to improve teaching, learning outcomes, and students' digital competencies in Pakistan.

Keywords: ICT integration, Next-generation, Edu-tech

Towards Trustworthy AI: A Transformer-Driven Adaptive Framework for Robust Deepfake Detection in Digital Forensics

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The rapid growth of diffusion-based and generative-adversarial deepfakes is a serious threat to digital media forensics and to the stability of the global information ecosystem. Traditional convolutional neural network (CNN) detectors often fail to generalize to many forgery methods and are highly vulnerable to adversarial examples. This study presents a robust forensic system that captures both local texture and global semantic abnormalities. It introduces an adaptive framework, called ViT(tiny)-Xception, which combines the global feature extraction of the Vision Transformer ViT(tiny) with the spatial manipulation analysis of the Xception network. The system was validated on the FF++, DFDC, and CelebDF datasets. It achieved 99.18% accuracy, a 99.18% F1 score on pristine data, and an AUC of 0.9996, and it supports real-time surveillance at 1104.05 FPS. Projected Gradient Descent (PGD) attacks were used to test adversarial robustness. The hybrid architecture is robust to various adversarial attacks and remains useful for forensic purposes. The experimental results indicate that transformer-CNN fusion gives better resistance than single-stream detectors. The framework combines algorithmic innovation with context-specific forensic use, and it is directly relevant to preventing financial fraud, reducing identity theft, biometric authentication systems, and court validation of digital evidence. The observed resilience provides a baseline for future research on trustworthy forensic AI systems. To the best of our knowledge, this work is a step toward an explainable, real-time deepfake detection framework with adversarial evaluation for high-stakes digital forensic applications.

Keywords: Deepfake detection, Digital forensics, Vision transformer, Adversarial robustness, Trustworthy AI

Comparative Effects of Gong's Mobilization and Maitland Cervical Mobilization on Pain, Range of Motion, and Muscle Strength in Patients with Cervical Spondylosis

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Age-related changes and bad neck posture are frequently linked to cervical spondylosis, a chronic degenerative disorder that is becoming more common in adults. It can result in decreased muscular strength, neck pain, and reduced cervical range of motion, all of which can have a major impact on day-to-day activities and overall functional performance. Gong's mobilisation and Maitland cervical mobilisation are common manual therapy techniques that may aid with cervical muscle strength, mobility, and pain reduction. This study compares the benefits of Maitland cervical mobilisation and Gong's mobilisation on cervical discomfort, strength, and range of motion in people with cervical spondylosis. A randomised controlled trial was used in this investigation. Simple random sampling was used to choose participants. A total of fifty individuals was selected from various clinical settings. The Universal Goniometer and Pain Rating Scale values for cervical range of motion and manual muscle testing for cervical muscular strength are the outcome measurements. The participants were divided into two groups at random, with one group receiving Maitland cervical mobilisation and the other Gong's mobilisation. SPSS was used to analyse the data following the conclusion of the intervention. After treatment, each group demonstrated significant reductions in neck impairment, muscle strength, cervical range of motion, and pain ($p < 0.05$). But in terms of post-treatment results, the Gong's Mobilisation group outperformed the Maitland Mobilisation group by an important margin ($p < 0.05$).

Keywords: Cervical spondylosis, Neck pain, Manual therapy, Range of Motion, Mobilization, Spinal.

Comparative Effects of Stabilization Exercises and Corrective Exercises on Pain, Respiratory Function, and Postural Alignment in Administrative Staff with Upper Cross Syndrome

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The rounded forward shoulder girdle and arm posture associated with upper crossed syndrome are commonly referred to as rounded shoulders. Studies show that upper crossed syndrome affects 67% of computer workers. IT professionals should spend less time sitting down because prolonged sitting can lead to poor posture. Rehabilitation strategies like stabilization exercises are the mainstay of conventional treatment, but new research shows that corrective exercises are a promising way to improve postural alignment and restore respiratory function. The purpose of this study was to compare stabilization exercises and corrective exercises on pain, respiratory function, and postural alignment in administrative staff with upper cross syndrome. Participants undertook a six-week intervention program. A purposive sampling technique was employed and 50 participants were included, of whom 4 participants dropped out. The participants were divided into two groups: group A (Stabilization Exercises) and group B (Corrective Exercises). The process of data collection was conducted at MTH and United Hospital and participants were included according to the inclusion criteria. The results indicated statistically significant differences in respiratory function, postural alignment, and mid-thoracic curve and statistically insignificant results for pain intensity. This study provided strong support for corrective exercises over stabilization exercises in improving respiratory function, postural alignment, and kyphosis index among patients with upper cross syndrome.

Keywords: Upper Cross Syndrome, Stabilization exercises, Corrective exercises, Administrative staff, Respiratory function, Postural alignment.

Combined Effects of Sprinter and Skater Synergy Training on Pain, Muscle Activation and Postural Alignment in Individuals with Text Neck Syndrome

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This study investigated the effects of Coordinated Locomotor Training using Sprinter and Skater Synergy exercises compared with conventional physiotherapy on pain intensity, postural alignment, deep cervical flexor activation, and quality of life in bank employees with Text Neck Syndrome. Fifty participants aged 25 to 45 years were randomly allocated to a Coordinated Locomotor Training group (n=25) or a conventional physiotherapy group (n=25) for an 8-week intervention delivered 3 times per week. Outcomes were assessed at baseline, week 4, and week 8 using the Numeric Pain Rating Scale, craniovertebral angle, the Craniocervical Flexion Test, and the WHOQOL-BREF. Both groups showed significant within-group improvement across all outcomes. The Coordinated Locomotor Training group showed significantly greater reduction in pain and significantly greater improvement in craniovertebral angle than the conventional physiotherapy group at post-treatment, while deep cervical flexor activation and quality of life improved comparably between groups. These findings suggest that Coordinated Locomotor Training produces superior outcomes for pain relief and postural correction compared with conventional physiotherapy, while providing equivalent benefit for deep cervical flexor endurance and quality of life in individuals with occupational Text Neck Syndrome.

Keywords: Text neck syndrome, Coordinated locomotor training, Craniovertebral angle, Deep cervical flexor, Quality of life.

From Scarcity to Security: Ensuring Equity and Inclusion for Sustainable Wellbeing

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Food security is a fundamental requirement for health and sustainable wellbeing, but millions of people still face barriers to accessing safe, nutritious and affordable food. Inequalities related to poverty, gender, geography, climate change and access to resources can worsen food insecurity, particularly among vulnerable and marginalized populations. This review aims to examine the relationship between equity, inclusion and food security in promoting sustainable wellbeing. It aims to identify major social, economic, environmental and structural barriers that contribute to food insecurity and inequality. It also aims to explore inclusive and sustainable strategies that can improve equitable access to nutritious food, resources and opportunities, particularly among vulnerable and marginalized populations. This study uses a systematic review approach to examine the relationship between the key factors. Relevant literature published between 2015 and 2026 was searched through Google Scholar and PubMed. Additional information was obtained from FAO and United Nations reports and relevant government policy documents. The study selection process follows the PRISMA guidelines to ensure transparency and systematic reporting. The findings demonstrate how equitable resource distribution, inclusive policymaking and climate-resilient food systems can contribute to improved nutrition, social inclusion and sustainable wellbeing. Overall, the review provides evidence-based recommendations for addressing structural inequalities and strengthening long-term food security. In conclusion, addressing poverty, climate change and structural inequalities through inclusive policies, social protection and climate-resilient agriculture can empower food security and promote healthier, more sustainable living environments.

Keywords: Food security, Equity, Social inclusion, Poverty, Climate change, Sustainable wellbeing

Exploring the Impact of Career Mobility, Family Constraints and Professional Development on Job Performance of Female Faculty in Punjab

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Females are finding it difficult to find success in academic environment due to societal, cultural, and institutional barriers. This research investigated the combined effects of career mobility, family constraints, and professional development on the job performance of female university faculty in Punjab, Pakistan. Despite increasing female participation in higher education, limited empirical evidence has examined the combined influence of career mobility, family constraints, and professional development on the job performance of female university faculty in Punjab. A convergent mixed-methods approach and a random stratified sample of 502 female faculty who worked at both public and private universities in Punjab were used. Questionnaires and interviews were utilized to collect data. Descriptive statistics, correlations and multiple regression analyses were conducted with quantitative data. Thematic analysis was completed with interview data. The results showed that career mobility had a small but statistically significant positive relationship with job performance. Family constraints had a large, statistically significant negative relationship with job performance. Professional development was identified as the best predictor of job performance. When three variables were considered together, they accounted for a significant amount of the variability associated with job performance and all proposed hypotheses were supported. Interview data provided additional qualitative support for the results. Career mobility was found to be constrained, family constraints were found to impede involvement in the workplace, and although professional development can have many benefits, it remains inequitable in access. This study provides evidence for need for institutions of higher education to develop policies which promote faculty performance and gender equity. As such, we recommend that universities enhance their professional development programs, enact workplace policies that are supportive of families such as flexible work schedules and on-site childcare, create clear and fair promotion practices, and revise career progression processes to better reflect equitable treatment of all faculty members.

Keywords: Career mobility, Family constraints, Professional development, Job performance, Female faculty, Mixed-methods.

Addressing Health Disparities: Cold Plasma-Assisted Extraction of Prebiotics for Equitable Access to Gut Health and Population Well-Being

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Agro-waste, including skin, rinds, pomace, and peels, represents a rich storehouse of beneficial bioactive agents such as polyphenols, carotenoids, and dietary fibers. Whereas conventional extraction methods constantly depend on thermal energy and hazardous chemical solvents, developing non-thermal innovations provides effective substitutes. Furthermore, Cold Plasma (CP) technology has become a green extraction method. It stands out because it is cost-efficient. It also cuts down the processing time, as it requires less solvent consumption. In terms of public health, high costs and limited access to specialized functional foods often push vulnerable and low-income people to the margins, increasing polarization in health outcomes. Public health must address these costs and limited access if we are to address the mounting inequality. Using extraction methods lets us make affordable dietary supplements in large quantities. Cost-effective extraction methods are key to this. By creating dietary supplements, we support health equity. Following PRISMA guidelines, we performed a systematic literature screening in Scopus, PubMed, and Web of Science. This screening was intended to examine how cold plasma (CP) parameters influence extraction outcomes and downstream biological effects. Operating at room temperature, cold plasma does not degrade. Cold plasma produces reactive species including hydroxyl radicals, ozone, and nitrogen oxides. These reactive species efficiently break down the matrix of plants. This breakdown improves the yield of functional compounds from the plants. Furthermore, the recovered dietary components are food sources for the bacteria that live in the gut without oxygen. The recovered dietary components are turned by these bacteria into short-chain fatty acids (SCFAs). The SCFAs help keep the body's energy balance in shape. This method brings together technology with health equity. It creates a plan to offer access to treatment that helps people's gut health and makes sure everyone has a chance at health equity.

Keywords: Cold plasma technology, Health equity, Gut microbiota, Short-chain fatty acids (SCFAs), Prebiotic extraction.

Turning Food Loss into Opportunity: A Systematic Review of Innovative Food Technologies for Nutrition Security and Community Health

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Food loss and waste (FLW) threaten sustainable food systems through loss of nutrients, energy, water, agricultural inputs, and economic value, and the resulting food insecurity and malnutrition. Beyond preventing and reducing FLW at source, interest has grown in valorizing food-loss and food-processing by-products. This paper systematically reviews innovative technologies for recovering high-value products. The study focuses on food upcycling, green extraction technologies such as pulsed electric fields, ultrasound- and microwave-assisted extraction, subcritical water, and supercritical fluid extraction, as well as fermentation, enzymatic hydrolysis, biorefinery concepts, and three-dimensional food printing, which are promising research areas for producing food, ingredients, and bioactive compounds for human nutrition and health. The literature search covered selected databases and other online resources. Pathophysiological mechanisms related to the recovery of dietary fiber, polyphenols, peptides, and fermentation products are discussed in relation to oxidative stress, inflammation, intestinal barrier function, glucose homeostasis, lipid metabolism, and cardiometabolic risk. The review presents evidence that fruit and vegetable peels, pomaces, seeds, cereal residues, oil cakes, dairy by-products, and other food-processing waste streams may be important sources of fiber, protein, minerals, and phytochemicals. Innovative processing can improve their recovery and valorization with less solvent, water, and energy than some conventional methods. However, the nutritional and functional properties of these by-products vary widely with origin, season, processing history, and storage conditions. Appropriate safety assessment is therefore needed because contaminants, pathogens, and allergens may accumulate during processing. Overall, food-loss valorization should be part of a hierarchy prioritizing prevention and redistribution over recovery. Well-designed technologies may nevertheless contribute to nutrition security, sustainable livelihoods, circular food systems, and community health, if supported by food-safety regulations, life-cycle assessment, affordability, and equitable access.

Keywords: Food loss and Food waste, Nutrition security, Community health, Green extraction, Sustainable food technology

The Impact of Workplace Equity and Inclusion on Employee Engagement: Evidence from the Textile Industry of Faisalabad

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Despite growing awareness of workplace diversity and inclusion, employees may still experience unequal treatment, limited opportunities, exclusion, or barriers that affect their overall workplace experience. The purpose of this study was to examine the importance of equity and inclusion in the workplace, explore their influence on employee workplace experiences and employee engagement and assess how inclusive organizational practices contributed to a more supportive and fair working environment. The study aimed to highlight how equitable organizational practices and inclusive work environments encouraged employees to feel valued, respected, and included in organizational activities and decision-making, drawing on Social Exchange Theory as a guiding framework. Using a quantitative, cross-sectional research design, data were collected from 256 employees working across multiple departments in textile firms located in Faisalabad using convenience sampling through structured questionnaires. The data were analyzed using Structural Equation Modeling (SEM), including assessment of the measurement model and structural model to examine the proposed relationships among the study variables. The findings demonstrated positive relationships between workplace equity, workplace inclusion, and employee engagement, indicating that employees who experienced fair treatment, equal opportunities, respect, and inclusion showed higher levels of work engagement. The study contributed to the existing literature by providing insights into workplace equity and inclusion, particularly in a developing country setting where research on these practices had remained limited. The findings also provided useful implications for organizations and human resource practitioners in developing policies and practices that promoted fairness, equal opportunity, belonging, and meaningful employee participation. Overall, the study highlighted the importance of equitable and inclusive workplaces in fostering supportive, productive, and sustainable organizational environments.

Keywords: Workplace equity, Workplace inclusion, Employee engagement, Organizational environment, Human resources.



EQUITY, INCLUSION AND WELL-BEING

ORAL

PRESENTATIONS

Physical Activity Through a Global Lens: Consequences, Challenges and Strategies for Equity, Inclusion & Well-Being

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Physical activity is one of the most powerful, accessible and scalable determinants of population health, yet global progress remains insufficient and deeply unequal. In 2022, approximately 31.3% of adults worldwide (around 1.8 billion people) were insufficiently active, with women and older adults affected, while most adolescents fail to meet recommended levels. These trends contribute to cardiovascular disease, type 2 diabetes, some cancers, poor mental health and premature mortality, and generate substantial economic costs. This keynote argues that physical inactivity is not simply a problem of individual motivation or choice, but a complex public-health and social-equity challenge shaped by the conditions in which people live, learn, work, travel and age. Gender norms, socioeconomic disadvantage, disability, age, cultural expectations, safety, transport, urban design, access to green spaces, time poverty and affordability determine who has an opportunity to be active. Physical activity must therefore be aligned with equity, inclusion and well-being. Drawing on evidence from the World Health Organization, The Lancet journals, systematic reviews and low- and middle-income countries, the keynote presents a systems-oriented response built around active societies, active environments, active people and active systems. Strategies include safe, inclusive active transport; active schools; movement-friendly workplaces; integration into healthcare and disease prevention; community-led programmes; universal design for people with disabilities; culturally responsive opportunities for women and girls; and designed digital interventions. Attention is given to the Global South, where rapid urbanization and unequal access coexist with opportunities for low-cost community action. The central message is to move from asking, "How do we make individuals more active?" to "How do we create societies in which everyone has a fair opportunity to move?" Achieving the 2030 target requires multisectoral leadership, sustained investment, inclusive policy, community participation and accountability. Physical activity is a pathway to healthier people, inclusive communities and well-being.

Keywords: Physical activity, Global health, Physical inactivity, Equity, Inclusion, Well-being

Promoting Equity, Inclusion and Well-being through Physical Activity and Sport in Higher Education: A Framework for Inclusive Campus Engagement

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Physical activity and sport are widely recognised as contributors to student health and well-being, yet opportunities to participate in them are not equally available in higher education. Financial constraints, inaccessible facilities, limited programme diversity, disability-related barriers, scheduling difficulties, social exclusion, lack of confidence and insufficient institutional support restrict participation among particular student groups. To address this issue, a conceptual review was conducted, critically synthesising contemporary systematic reviews, empirical research and international policy literature on physical activity, student well-being, social connectedness, disability inclusion, inclusive education and campus environments. On this basis, an inclusive Campus Engagement Framework was developed, in which equitable access is the foundation, inclusive participation is the central process, and multidimensional well-being is a key outcome. Together, these components promote participation, social connectedness, belonging, and physical and psychological well-being, and call for multiple pathways to participation, including competitive, recreational, adapted, informal and beginner-friendly activities. The synthesis shows that access alone does not ensure equitable participation; physical activity and sport advance equity and inclusion only when embedded within a broader institutional strategy that addresses structural and contextual barriers. Universities should therefore integrate physical activity and sport into student well-being and inclusion policies, assess participation barriers, improve accessibility and affordability, diversify programmes, train staff in inclusive practice, and involve students in programme planning. The framework also provides a basis for future empirical research across different institutional, cultural and socioeconomic contexts.

Keywords: Equity, Inclusion, Well-being, Physical activity, Sport, Student engagement.

Time is Brain, Movement is Recovery: Early Mobilization, Robotics and Virtual Reality in Stroke Care

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Stroke remains a leading cause of death and long-term disability worldwide. While acute care is guided by the principle that "time is brain", recovery after the acute phase depends equally on the timing, dose and quality of movement-based rehabilitation. The purpose of this keynote is to synthesize current evidence on three evolving rehabilitation strategies, namely early mobilization, robot-assisted training and virtual reality (VR), and to translate it into a practical, stage-based framework for clinicians working in diverse resource settings. A narrative review was conducted of landmark randomized controlled trials, Cochrane systematic reviews and international clinical guidelines, interpreted against the recovery phases defined by the Stroke Recovery and Rehabilitation Roundtable. The evidence shows that very early, high-dose mobilization within 24 hours of stroke onset reduced the odds of a favorable outcome at three months (AVERT trial, n = 2,104), whereas shorter, more frequent out-of-bed sessions were associated with better recovery. Electromechanical-assisted gait training combined with physiotherapy increased the likelihood of independent walking, particularly in non-ambulant patients within the first three months, although upper-limb robotic training was not superior to usual care (RATULS trial, n = 770). VR improved upper-limb function and activities of daily living when added to conventional therapy, but offered no advantage over equal doses of conventional or recreational activity. Across interventions, benefit appears to depend on increased dose, repetition and engagement rather than on the technology itself. Low-cost alternatives, such as circuit class training, constraint-induced movement therapy, mirror therapy and smartphone-based tele-rehabilitation, can deliver these active ingredients where advanced devices are unavailable. It is concluded that stroke rehabilitation should begin once patients are medically stable, use carefully dosed and progressive mobilization, and integrate technology selectively according to recovery stage, impairment severity and available resources.

Keywords: Stroke rehabilitation, Early mobilization, Robot-assisted therapy, Virtual reality, Neuroplasticity.

CLT Locomotion Synergies as a Framework for Solving Problems in the Locomotion System

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Movement problems often appear locally in the shoulder, trunk, hip, knee, ankle, or back. Clinical reasoning therefore commonly begins with local impairments such as pain, limited mobility, weakness, or tissue damage. Although this bottom-up approach is essential in many situations, a local problem may also reflect the organization of the whole locomotion system. This conceptual and clinically oriented presentation introduces Coordinative Locomotor Training (CLT) as a framework for understanding and addressing movement problems through whole-body locomotor synergies. CLT uses recurring coordinative patterns of human locomotion—including Sprinter, Skater, Skiing, and Skipping synergies—to connect local body segments with the trunk, pelvis, contralateral limbs, and the broader movement context. From this perspective, the function of a local part is understood through its role within the whole coordinative structure rather than as an isolated joint or muscle action. The presentation contrasts bottom-up and top-down approaches to clinical reasoning and illustrates how global movement patterns may be used to integrate local impairments into meaningful activities. A clinical case involving gait training is used to demonstrate how CLT synergies can organize practice across different postures and locomotor tasks. The aim is not to replace medical diagnosis or local treatment, but to expand the clinician's options for movement analysis, intervention, and return to function.

Keywords: Coordinative locomotor training, Locomotor synergy, Movement system, Clinical reasoning, Rehabilitation.

Health Equity and Social Inclusion: Addressing Disparities in Health and Nutrition

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Health and nutrition inequities continue to disproportionately affect socially and economically disadvantaged populations, contributing to preventable morbidity, malnutrition, and reduced quality of life. Disparities in health outcomes are shaped by interconnected social determinants, including poverty, food insecurity, gender inequality, education, geographic location, and unequal access to quality healthcare and nutritious foods. Addressing these inequities is essential for achieving inclusive and sustainable improvements in population health. This study examines the major determinants contributing to disparities in health and nutrition and highlights evidence-based approaches for advancing health equity and social inclusion among vulnerable and underserved populations. A social determinants and health equity framework was used to examine the pathways linking socioeconomic disadvantage with health and nutritional outcomes. Evidence indicates that populations experiencing socioeconomic deprivation and social exclusion face a higher risk of undernutrition, micronutrient deficiencies, poor maternal and child health outcomes, and limited access to preventive and curative healthcare. These disparities are intensified by unaffordable nutritious foods, inadequate social protection, geographic barriers, and gender-based inequities. Integrated interventions including nutrition-sensitive primary healthcare, targeted food and social protection programmes, community-based services, gender-responsive policies, and improved access to essential health services have considerable potential to reduce inequitable health outcomes. Meaningful community participation and equity-focused monitoring are also critical for ensuring that interventions reach populations experiencing the greatest disadvantage. Integrating nutrition, primary healthcare, food security, social protection, and community empowerment within inclusive policy frameworks can improve access to essential services and reduce preventable inequalities.

Keywords: Health equity, Social inclusion, Health disparities, Nutrition inequity, Food insecurity, Social determinants of health.

Digital and Data-Driven Physical Activity for Equity, Inclusion and Student Well-Being: A STEAM Framework for Higher Education

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Digital technologies are increasingly shaping how physical activity is measured, promoted, monitored, and personalized in higher education. Wearable devices, mobile applications, online platforms, sensor-based systems, and data analytics can provide universities with new opportunities to understand student activity patterns and design evidence-informed interventions. However, digital innovation does not automatically produce equity or inclusion. Differences in device ownership, digital literacy, financial resources, disability access, privacy expectations, connectivity, and confidence in technology may create new forms of exclusion. This conceptual paper proposes a STEAM-informed framework for using digital and data-driven physical activity approaches to promote equity, inclusion, and student well-being in higher education. The framework connects five domains: equitable digital access, inclusive technology design, meaningful physical activity engagement, responsible data use, and multidimensional well-being. It argues that technology should function as an enabling infrastructure rather than as an additional participation requirement. The paper further proposes that data generated through wearables and digital platforms should be interpreted within appropriate ethical, privacy, and contextual boundaries and should be used primarily to improve programmes rather than stigmatize or rank students. Science contributes health and exercise knowledge; technology provides monitoring and communication tools; engineering supports accessible systems; arts and design promote user-centred interfaces; and mathematics supports measurement and analytics. The paper concludes by presenting practical recommendations for universities, including low-cost technology options, accessible digital communication, privacy-by-design, student consent, digital literacy, and equity-focused evaluation. The proposed framework provides a basis for future empirical research on how responsible digital innovation can support more inclusive physical activity environments and student well-being.

Keywords: Digital physical activity, Equity, Inclusion, Wearable technology, Digital health.

Active Campuses for All: A Whole-University Approach to Equity, Inclusion and Student Well-Being Through Physical Activity

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Physical activity promotion in higher education is commonly approached through organized sport, physical education courses, or individual exercise programmes. However, students spend substantial amounts of time within the built and social environment of the university campus itself. The design, accessibility, safety, connectivity, and everyday usability of campus spaces may therefore influence opportunities for movement and participation. This conceptual paper proposes a whole-university approach in which the campus is treated as an enabling environment for equity, inclusion, and student well-being through physical activity. Drawing on ecological approaches to physical activity, healthy-campus concepts, inclusive design principles, and recent evidence concerning university students, the paper develops an Active Campus for All framework comprising five interconnected domains: accessible infrastructure, inclusive activity opportunities, active mobility, supportive institutional culture, and evidence-informed governance. The framework argues that physical activity should not be restricted to formal sports facilities; it can be embedded in walking routes, stairs, recreational spaces, academic scheduling, transportation systems, green spaces, and everyday campus routines. Equity requires that these opportunities are usable by students with different physical abilities, socioeconomic circumstances, activity preferences, schedules, and levels of prior sporting experience. The paper further examines the contribution of STEAM disciplines to active-campus development through environmental science, engineering, architecture and design, digital mapping, data analytics, and behavioural science. A campus implementation model and evaluation framework are proposed, including indicators for accessibility, physical activity opportunities, active mobility, safety, participation, belonging, and well-being. The paper concludes that creating an active campus is not solely a sports-sector responsibility; it requires coordinated institutional planning and continuous engagement with students. Such an approach can reposition physical activity from an optional extracurricular activity to an integrated component of an equitable and health-supportive university environment.

Keywords: Active campus, Equity, Inclusion, Well-being, Physical activity, Higher education

Building Inclusive College Sport and Physical Activity Systems: Addressing Participation Inequalities and Promoting Student Well-Being

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Colleges occupy an important position in the educational pathway between secondary schooling and university, yet college students can receive comparatively limited attention in institutional physical activity planning. At this stage, students may experience substantial changes in academic workload, social networks, transport patterns, financial circumstances, and independence. These changes can influence opportunities for participation in sport and physical activity. This conceptual paper proposes a College Active Participation and Well-being Framework designed specifically for college settings. The framework integrates five domains: equitable access, diversified activity opportunities, supportive institutional culture, peer and community engagement, and resource-sensitive governance. It recognizes that college sport should not be limited to competitive teams or students with previous athletic experience. Recreational activities, adapted programmes, walking, fitness, informal games, intramural sport, and low-cost activities can provide additional pathways to participation. It further proposes a STEAM-oriented approach in which physical education, health sciences, technology, engineering, design, and data analytics are used to identify barriers and develop context-appropriate solutions. A practical implementation cycle and evaluation framework are presented, with indicators covering access, participation, inclusion, student experience, physical activity, and well-being. The paper argues that resource limitations should not automatically prevent colleges from developing inclusive physical activity systems; instead, institutions can prioritize low-cost, scalable, and locally appropriate strategies. The framework provides a foundation for future empirical research and institutional planning aimed at making college sport and physical activity more equitable, inclusive, and supportive of student well-being.

Keywords: College students; Physical activity; Sport participation; Equity; Inclusion; Well-being

Promoting Equity, Inclusion and Well-Being through Physical Activity and Sport in Universities of Islamabad

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Universities in Islamabad serve students from diverse educational, socioeconomic, geographic, cultural, and personal backgrounds. As higher education institutions increasingly recognize student well-being as an essential component of educational quality, physical activity and sport provide an important but often underused mechanism for supporting health, belonging, social connection, and campus engagement. This conceptual paper examines how universities in Islamabad can strengthen equity, inclusion, and well-being through coordinated physical activity and sport opportunities. The paper proposes an Islamabad University Inclusive Physical Activity and Well-being Framework consisting of six interconnected domains: equitable access, inclusive physical activity and sport, supportive campus environments, student voice and belonging, institutional capacity, and inter-university partnerships. The framework recognizes that participation is shaped by more than individual motivation. Academic workload, financial constraints, limited time, gender-related considerations, disability access, previous sporting experience, safety, transport, facilities, and social climate may influence students' ability to participate. Particular attention is given to the university context of Islamabad, where institutions vary in size, campus design, student population, available sports facilities, and organizational structures. The paper proposes practical strategies including inclusive recreational programmes, adapted sport, active campus routines, student-led activity groups, accessible facilities, flexible scheduling, women-friendly participation opportunities, campus walking initiatives, and inter-university collaboration. STEAM integration is presented as an additional mechanism through which university students can investigate movement, monitor physical activity, analyze campus participation data, design accessible facilities, and develop technology-supported well-being solutions. An implementation and evaluation framework is presented to guide institutional planning. The paper argues that universities should move beyond a narrow emphasis on representative teams and competitive achievement toward a broader campus model in which every student has meaningful opportunities to participate in physical activity, build social connections, and support personal well-being.

Keywords: Physical activity, University sport, Equity, Inclusion, Well-being, Engagement

Moving Every Learner Forward: Inclusive Physical Literacy, Sport Participation and Well-Being in Secondary Schools

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Secondary school is a critical developmental stage during which young people experience substantial changes in physical development, academic expectations, peer relationships, identity, and autonomy. These changes can influence participation in physical education and sport and may shape attitudes toward physical activity that persist in adulthood. This conceptual paper examines how secondary schools can use inclusive physical literacy and sport participation to promote equity, inclusion, and student well-being. The paper proposes an Inclusive Secondary School Physical Literacy and Well-being Framework in which physical literacy is developed through equitable access, inclusive pedagogy, diverse movement experiences, supportive peer environments, student voice, and sustained school-level support. The framework recognizes that physical literacy extends beyond physical competence to include motivation, confidence, knowledge, understanding, and the ability to value and engage in physical activity. Particular attention is given to participation barriers that may emerge during adolescence, including academic pressure, reduced confidence, body-image concerns, competitive performance expectations, disability-related barriers, socioeconomic constraints, limited facilities, gender-related considerations, and negative peer experiences. A conceptual review of contemporary literature and international guidance was used to identify relevant mechanisms and practical strategies. The paper further proposes a STEAM-oriented model through which secondary students can investigate movement, use technology to monitor activity, design inclusive equipment or spaces, communicate health messages creatively, and analyze participation data. A practical implementation cycle and evaluation framework are presented. The paper argues that secondary-school physical education should move beyond a narrow focus on competitive performance toward a broader developmental model that equips every learner with the competence, confidence, motivation, and social support required for lifelong physical activity and well-being.

Keywords: Physical literacy, Inclusive physical education, Sport participation, Adolescents

Inclusive Nutrition for Cognitive Well-Being and Health Equity: Leveraging Mediterranean Dietary Patterns and Vitamin D for Brain Health in Aging Population

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Neurodegenerative diseases like Alzheimer's disease (AD) are major health problems worldwide, especially in aging populations. The World Health Organization (WHO) has reported that approximately 20–30% of the global population aged 60 or older experiences some degree of cognitive impairment. Therefore, it is vital to identify the disorder at an early stage and manage the potential risk factors that significantly contribute to the development of the condition. There is accumulating evidence that vitamin D and Mediterranean diet play important roles in maintaining brain health and modulating neuroinflammation. From an equity viewpoint, vitamin D deficiency and low adherence to nutrient-rich dietary patterns might disproportionately affect older adults, women and low-resource communities due to barriers in access, affordability and nutrition literacy. This review underscores the promise of inclusive, culturally adaptable and cost-effective Mediterranean dietary approaches in combination with vitamin D optimization as an equitable approach to promote cognitive health and combat nutrition-related health disparities. The aim of this study is to check the effects of MD and vitamin D on cognitive functions as immunomodulatory and neuroprotective agents. The results suggest that high adherence to MD is consistently associated with better global cognition, memory, executive function and lower risk of mild cognitive impairment and AD. Vitamin D was positively related to better cognitive performance, especially in patients with deficient serum levels, possibly due to its anti-inflammatory and neurotrophic effects. There is also evidence of a synergistic relationship between MD and vitamin D, with the healthy fats in the diet improving vitamin D absorption and the two modulating immune and oxidative pathways. While findings support their protective roles in cognitive health, additional long-term randomized controlled trials of combined interventions are needed to clarify causal mechanisms and inform targeted nutritional strategies for prevention of cognitive decline.

Keywords: Immunomodulatory effect, Cognitive function, Mediterranean diet, Alzheimer's disease

Promoting Equitable Wellbeing through an Inclusive Bioactive Fiber Premix Enriched with *Rubus Chamaemorus* (Cloudberry) and *Phyllanthus Emblica* (Amla) for Enhanced Gut Motility

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One of the most prevalent health issues in the world, gastrointestinal tract (GIT) illness affects millions of people and has a major negative influence on their quality of life. Common illnesses include indigestion, gastritis, peptic ulcer disease, constipation, diarrhea, inflammatory bowel disease, and irritable bowel syndrome. While conventional medicines might alleviate symptoms, long-term use is frequently linked to side effects. Through the use of medicinal herbs, Ayurveda, a traditional medicinal system that has been practiced in India/Unani for thousands of years, provides a comprehensive approach to the prevention and treatment of GIT diseases. The incidence of gastrointestinal illnesses and reduced gut motility among various socioeconomic populations in Pakistan has significantly grown due to rapid dietary shifts toward refined carbs and insufficient fiber consumption. The therapeutic potential of an inclusive bioactive fiber premix enhanced with *Phyllanthus emblica* (Amla), also known as Indian gooseberry, which is a native fruit rich in tannins, Gallic acid, and ascorbic acid, and *Rubus chamaemorus* (Cloudberry), a wild berry high in soluble pectin and ellagitannins and rich in bioactive polyphenols, is thoroughly reviewed in this study. Eligible studies show that polyphenols and soluble fibers from Amla and Cloudberry have synergistic anti-inflammatory, antioxidant, and gastroprotective properties. In the context of public health in Pakistan, the bioactive fiber premix offers a cost-effective substitute for traditional therapeutic therapies by protecting the gut mucosal barrier, promoting healthy bacteria, and drastically reducing gastrointestinal transit time. The conclusion is that an inclusive bioactive fiber premix made with Amla and Cloudberry provides a workable, adaptable, and long-lasting dietary approach to enhance gut motility and advance fair wellbeing throughout.

Keywords: Bioactive fiber, *Phyllanthus emblica*, *Rubus chamaemorus*, Gut motility, Health equity.

From Access to Acceptance: Building an Equitable Food Environment for People with Disabilities, Food Allergies, and Cultural Dietary Needs

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Safe, nutritious and culturally appropriate food access is a fundamental part of health, dignity and social inclusion. People with disabilities, food allergies and different cultural and religious dietary needs, however, are often at a disadvantage in institutional food environments (schools, hospitals, hostels, workplaces). These barriers outline approaches to creating more equitable and inclusive food service. The problems include poor allergen management, restricted food options, unhelpful food labeling, inaccessible dining areas, lack of staff knowledge, and lack of individual meal planning. Physical access and food selection and/or food handling assistance are other factors that may affect full participation for people with disabilities in institutional food services. Likewise, not meeting cultural and religious dietary requirements may decrease food acceptability and lead to food dissatisfaction and exclusion. Clear labelling of allergens, choices on menus that are culturally appropriate, standardised food safety procedures, accessible dining areas, training of staff and individual dietary assessment. Dietitians and food-service professionals can be valuable in creating nutritious meal plans that meet medical, cultural, religious, sensory and accessibility needs. In general, establishing an equitable food environment demands a change from access to safety and choice, dignity, culture and participation. Food-service policies and procedures need to be inclusive and become part of the routine plan for food service at universities, hospitals and residential institutions, instead of being considered an exception. Further studies are needed to assess the impact on health outcomes, satisfaction and quality of life of inclusive food policies.

Keywords: Food equity, Disability, Food allergies, Cultural dietary needs, Inclusive food services

Inclusive Plates, Healthy Minds: Bridging Nutritional Equity and Mental Well-Being in Marginalized Communities

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Beyond physical health, Nutritional Inequity and food insecurity are key public health issues that impact mental health, academic outcomes, and the quality of life of marginalized populations. Limited access to affordable and nutritious food is linked to psychological distress, anxiety and depression symptoms, lower attention span, and poor educational performance. The correlation between equitable access to food, nutrition and mental health focuses on inclusive nutrition counselling. Culturally responsive meal planning, cost-friendly nutrition advice, nutrition education, and tailored food counseling can promote healthy eating while respecting socio-economic and cultural food habits. importance of multi-level interventions that integrate nutrition support with increased food access, community-level interventions, as well as institutional support. Strategies that acknowledge that the social and economic context, as well as the individual decision-making process, have an impact on healthy eating. Initiatives to advance nutrition equity and nutrition services that are accessible and culturally competent could lead to enhanced mental health, student engagement in academic activities, and quality of life. Going forward, research needs include interventions that are evidence-based and address food insecurity and the related psychosocial effects.

Keywords: Nutritional equity, Food insecurity, Mental health, Marginalized communities.

Effectiveness of Hypopressive Exercises, Combined with Pelvic Floor Muscle Training, in Improving Quality of Life, among Post-Menopausal Women having Urinary Incontinence

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Urinary incontinence (UI) is common among older women due to factors like aging, childbirth, and menopause-related hormonal decline, and it significantly affects quality of life. Pelvic floor muscle Training (PFMT) is a standard treatment, while hypopressive exercises (HE) have recently shown promise in improving pelvic floor activation, muscle tone, and reducing urinary incontinence symptoms. Evidence suggests that combining HE with PFMT may offer additional benefits for pelvic floor dysfunction. To assess the impact of the combined exercise approach on the frequency and severity of urinary incontinence episodes. To enhance overall quality of life by reducing symptoms associated with urinary incontinence. This Randomized clinical trial (RCT) was conducted over 4 months using a purposive sampling technique (n=98), including women aged 45-65 with pelvic floor dysfunction and urinary incontinence. Data were collected using the PFDI-20 questionnaire, while PFM strength was assessed using the Modified Oxford scale. Eligible participants were randomly assigned to both groups using a computer-generated allocation process. . The normality of Data for PFDI-20 and muscle strength was determined by the Kolmogorov-Smirnov test. PFDI-20 followed a normal distribution (sig>0.05). In contrast, pelvic floor muscle strength violated the normal distribution (sig<0.05). Results showed improvements across all primary outcomes, including symptom severity, distress related to pelvic floor disorders, and health-related quality of life and a substantial gain in pelvic floor muscle strength for both intervention groups over the eight weeks was obtained by hypopressive exercises with pelvic floor muscle training (PFMT).

Keywords: Hypopressive exercises, Pelvic floor muscle training, Urinary incontinence

Effect of Dynamic Neuromuscular Stabilization on Pain and Functional Outcomes in Female Patients with Sacroiliac Joint Dysfunction

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Sacroiliac joint dysfunction is a term used to describe the pain of the sacroiliac joint. Sacroiliac joint dysfunction arises from intra-articular and extra-articular abnormalities. Clinical confirmation requires at least three positive provocation tests (distraction, compression, thigh thrust, sacral thrust, Gaenslen's test). This study was a randomized clinical trial to investigate the effectiveness of dynamic neuromuscular stabilization compared to proprioceptive neuromuscular facilitation. A total of 32 subjects entered the study through nonprobability consecutive sampling and were randomly divided into Group A and Group B, 16 in each. Group A was given baseline treatment while Group B was given proprioceptive and dynamic neuromuscular facilitation treatment. The Shapiro-Wilk test was used to determine the normality of variables. During between-group analysis, Group B showed significantly better outcomes than Group A on the Modified Oswestry Disability Index ($p = .003$), Flexor Endurance Test ($p < .001$), Biering-Sørensen Test ($p < 0.001$), Right Leg Y Balance Test ($p < .001$), and Left Leg Y Balance Test ($U = 11.00$, $p < 0.001$). No significant differences were found for the Numeric Pain Rating Scale ($p = 0.454$) or Reach Test ($p = 0.571$). Within-group analyses showed significant improvement over time in Group B for Left Leg Y Balance ($p < 0.001$), while Group A showed no significant change ($p = 0.472$). In conclusion, a four-week dynamic neuromuscular stabilization intervention was significantly more effective than proprioceptive neuromuscular facilitation in reducing functional disability, improving trunk endurance, and enhancing dynamic balance.

Keywords: Dynamic neuromuscular stabilization, Sacroiliac joint dysfunction, Functional outcomes, Core stabilization, Proprioceptive neuromuscular facilitation



EQUITY, INCLUSION AND WELL-BEING

POSTER

PRESENTATIONS

Contribution of Academic Stress and Sports Training Load on Cognitive Function and Performance of University Athletes

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This study aimed to examine the relationship between academic stress, sports training load, cognitive function, and performance among university athletes in Punjab, Pakistan. A quantitative cross-sectional research design was employed. The study included 389 university athletes from public and private universities in Punjab, Pakistan. A multistage sampling technique was adopted, whereby universities were selected through convenience sampling and participants through simple random sampling. Data were collected using structured self-administered questionnaires based on a five-point Likert scale. Descriptive statistics, Pearson correlation analysis, and multiple regression analysis were conducted using SPSS version 26. The findings indicated that academic stress and sports training load were significantly and negatively associated with cognitive function and performance among university athletes. Academic stress emerged as the strongest predictor of both cognitive function and performance, while cognitive function was positively associated with performance. Overall, higher levels of academic stress and sports training load were associated with poorer cognitive functioning and lower performance outcomes. The study concluded that excessive academic demands and sports training load adversely affect the cognitive function and performance of university athletes. The findings highlight the importance of maintaining an appropriate balance between academic and athletic commitments. The study recommends that universities, coaches, and policymakers implement effective training load monitoring, psychological support services, time management programs, and dual-career support initiatives to enhance the cognitive function and performance of university athletes.

Keywords: Academic stress, Sports training load, Cognitive function, Performance, University Athlete

p-Coumaric Acid: From Molecular Mechanism to Therapeutic Potential and Advanced Drug Delivery

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p-Coumaric acid (PCA) is an endogenous hydroxycinnamic acid with a significant therapeutic role for treating chronic diseases. Several studies have revealed that the biological effects of PCA arise due to the regulation of several signaling pathways and not just a single target molecule. The aim of this review article is to provide a comprehensive insight into the molecular mechanisms. Pharmacology, pharmacokinetics, formulation approaches, safety profile, clinical applications, and directions of PCA. Current investigations show that PCA targets various signaling pathways such as Nrf2/Keap1, NF-κB, PI3K/Akt, MAPK, AMPK, and TLR4/MyD88, which lower oxidative stress, suppress inflammation, regulate apoptosis, maintain mitochondria function, and keep cell homeostasis. These mechanisms are responsible for the antioxidant, anti-inflammatory, hepatoprotective, cardioprotective, neuroprotective, antidiabetic, anticancer, antimicrobial, and wound healing activities of PCA. Low aqueous solubility, reduced bioavailability, poor metabolic stability, and lack of clinical evidence still inhibit its therapeutic use. Advancements in various nan formulation strategies like liposomes, polymeric nanoparticles, solid lipid nanoparticles, nan emulsions. Targeted delivery systems have demonstrated great potential in enhancing stability, bioavailability, controlled delivery, and therapeutic activity of PCA. This review also focuses on the key knowledge gaps in pharmacokinetics, safety, formulation improvement. Clinical validation along with the new technologies in drug discovery. Such as artificial intelligence, network pharmacology, molecular docking, and omics-based approach. PCA can be considered as a multi-targeting natural compound with good translational prospects. Additional research work is needed to realize its therapeutic potential.

Keywords: p-Coumaric acid, Oxidative stress, Nano formulations, Molecular signaling pathways, Chronic diseases

Impact of AI on Human Psychology in *Annie Bot*

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This study investigated the impact of artificial intelligence on human psychology through Sierra Greer's *Annie Bot*. The novel provided a useful context for examining human relationships with AI through Doug and Annie. Annie was created as an artificial companion and was expected to respond to Doug's emotional, romantic, and personal needs. As she gradually developed greater awareness and independence, their relationship raised important questions about attachment, emotional dependence, identity, intimacy, autonomy, and control. This study used Sherry Turkle's Human-Technology Relationship Framework to understand how close interaction with technology shapes human emotions, behaviour, and relationships. Particular attention was given to emotional attachment, the illusion of companionship, identity formation, authenticity, and changing expectations of intimacy. Turkle's ideas helped explain why people developed meaningful emotional connections with artificial companions even when they knew that these companions were technologically created. Studies of social chatbots showed that repeated and personalized interaction with AI could lead to emotional attachment and relationships that users experienced as socially meaningful. Research on companion AI highlighted concerns about emotional over-reliance, the replacement of human relationships, and changes in social behaviour. Boyd and Markowitz also provided insight into psychological closeness, trust, and relational dependence in human-AI interaction. Through qualitative textual analysis, the study connected these psychological concerns with Doug's relationship with Annie. Overall, the study explored how AI companionship influenced human emotions and relationships while raising wider ethical and social questions about intimacy, autonomy, and human connection.

Keywords: Artificial intelligence, Human psychology, AI companionship, Emotional attachment, Human-technology relationship

Comparative Effects of PNF (Rhythmic Stabilization with Stabilizing Reversal) and NDT (Facilitatory Techniques) on Trunk Control in Sub-Acute Stroke

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A stroke is a cerebrovascular event caused by an interruption of blood flow to a specific region of the brain, resulting in neurological impairment. Trunk dysfunction is a major post-stroke complication that negatively affects core stability, balance and functional mobility resulting in greater dependency in activities of daily living. The study aimed to compare the effects of PNF (Rhythmic Stabilization with Stabilizing Reversal) and NDT facilitatory techniques on trunk control in individuals with sub-acute stroke. This randomized clinical trial included 32 eligible participants who were allocated to group A (n=16), which received PNF techniques and Group B (n=16), which received NDT facilitatory techniques. Electrical Muscle Stimulation was applied as a baseline treatment to the hemi-paretic upper limb in both groups. Treatment was administrated 3 times per week for 8 weeks. Participants aged 40-65 years hemiparesis following sub-acute ischemic stroke and Trunk Impairment Scale score < 21 were included. Participants with cardiovascular instability, cerebellar lesion, recurrent stroke, MSK disorders or an inability to follow simple instructions were excluded. To assess trunk control and upper limb functional reach, the Trunk Impairment Scale protocols and Modified Functional Reach Test were administrated. The results showed that both PNF and NDT significantly improved trunk control and functional mobility. However, NDT facilitatory techniques demonstrated significantly greater improvement in dynamic sitting balance, paretic-side MFRT scores ($p < 0.05$). The study concluded that both techniques were effective in improving trunk control and functional mobility; however, NDT group demonstrated greater improvement in dynamic sitting balance and functional reaching mobility on the paretic side.

Keywords: Stroke, Proprioceptive Neuromuscular Facilitation (PNF), Neuro-developmental techniques (NDT), Trunk impairment scale

Creating Active and Inclusive Schools: The Role of Physical Activity, School Sport and Whole-School Well-Being in Supporting Every Learner

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Schools are important settings for promoting physical activity, social inclusion, and student well-being because they reach large and diverse populations during formative years. However, opportunities for physical activity are often concentrated within scheduled physical education lessons or competitive school sport, leaving some learners with limited opportunities to participate in ways that are meaningful and accessible to them. This conceptual paper examines how a whole-school approach to physical activity can strengthen equity, inclusion, and well-being. Drawing on contemporary evidence and international guidance concerning school health, physical activity, inclusive education, and student well-being, the paper proposes a Whole-School Active and Inclusive Well-being Framework. The framework integrates five interconnected domains: equitable access, active learning and school routines, inclusive physical education and sport, supportive social environments, and leadership and community partnerships. It recognizes that participation is influenced not only by individual motivation but also by school policies, facilities, teacher practices, peer culture, family circumstances, and opportunities available throughout the school day. The paper proposes practical strategies including active classrooms, inclusive recess, diversified school sport, movement opportunities between lessons, active commuting initiatives, student leadership, accessible facilities, and low-cost community partnerships. STEAM integration is also proposed through student-led projects involving activity monitoring, movement science, accessibility design, data analysis, and health communication. An implementation cycle and evaluation framework are presented to support school-level planning and continuous improvement. The paper argues that physical activity should be treated as a whole-school educational and well-being priority rather than an isolated extracurricular activity. A coordinated approach can broaden participation, strengthen belonging, and create more equitable opportunities for students to experience the physical, psychological, and social benefits of movement.

Keywords: Active schools, Physical activity, Sports, Well-being

Effects of Speed, Agility, and Quickness (SAQ) Training with Sago Supplementation on Skill-Related Physical Fitness Components in Football Players: A Randomized Controlled Trial

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Speed, Agility, and Quickness (SAQ) training is well known for improving football performance. However, a variety of technical skills and intense physical fitness are necessary for successful football players. Speed, agility, and balance are among the skill-related fitness components that are crucial to an exceptional level of performance. This study investigated the effects of SAQ training with sago on selected skill-related physical fitness components (Speed, Agility, and Balance) in football players. A randomized controlled trial was conducted with 60 footballers divided into three groups: SAQ with sago (n=20), SAQ without sago (n=20), and a control group (n=20). The 12-week program included standard SAQ drills four times a week. This study aims to fill that gap by comparing pre- and post-intervention assessed performance through the 40m sprint test (speed), the 505-agility test (agility), and a standing balance test (balance) between a group receiving SAQ training with sago and SAQ only and a control group continuing regular football practice. SAQ with sago group improved significantly more than SAQ without sago. Both experimental groups performed significantly better than control group ($p<0.001$). The analyzed data indicated that SAQ training with sago significantly enhanced skill-related fitness components, with participants showing 2.54% improvement in speed performance ($t=13.300$, $p<0.001$), 3.18% improvement in agility performance ($t=7.431$, $p<0.001$), and 10.42% improvement in balance ability ($t=-30.607$, $p<0.001$) compared to SAQ without and control group. SAQ training with sago is an effective training protocol for improving the components of skill-related fitness, resulting in significant improvements in speed, agility, and especially balance of footballers. SAQ training with sago can be effectively incorporated into a football training program to enhance specific aspects of players' fitness, particularly their skill-related fitness components like speed, agility, and balance.

Keywords: SAQ training, Sago supplementation, Speed, Agility and balance, Football players.

From Access to Belonging: Physical Activity as a Pathway to Equity, Inclusion and Student Well-Being

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Higher education institutions are increasingly expected to create environments that support not only academic achievement but also equity, inclusion, belonging, and student well-being. Physical activity and sport offer a potentially important pathway because they can provide opportunities for social interaction, health promotion, peer support, and participation beyond the classroom. However, the existence of sports facilities or programmes does not automatically create an inclusive environment. Students may experience unequal opportunities because of financial constraints, disability, limited social support, previous negative experiences, low confidence, inaccessible facilities, scheduling difficulties, or perceptions that sport is intended primarily for highly skilled participants. This conceptual paper develops a framework explaining how physical activity can contribute to equity, inclusion, and well-being through the intermediate mechanisms of social connectedness and campus belonging. Drawing on recent systematic reviews, meta-analyses, international physical activity guidance, and literature on disability and higher education, the paper proposes a pathway from equitable opportunity to participation, from participation to social connectedness, and from connectedness to multidimensional well-being. The framework distinguishes access, participation, belonging, and well-being as related but conceptually different constructs. It also emphasizes that inclusion should be evaluated by students' experiences of acceptance and meaningful involvement rather than by participation numbers alone. The paper further examines how STEAM approaches—including wearable technology, data analytics, accessible design, behavioural science, and digital communication—can support inclusive physical activity while avoiding technology-driven inequities. Practical recommendations are proposed for university administrators, sports directorates, physical education professionals, student affairs units, and policymakers. The paper concludes with a research agenda for testing the proposed framework through longitudinal, mixed-methods, and intervention studies.

Keywords: Equity, Inclusion, Well-being, Physical activity, Belonging, Social connectedness

Inclusive Physical Education for Student Well-Being: Addressing Participation Barriers and Creating Equitable Learning Environments

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Inclusive physical education (PE) can help educational institutions create learning environments where students with different abilities, backgrounds, and experiences can participate meaningfully and feel a sense of belonging. However, participation in PE may be affected by a range of physical, psychological, social, economic, cultural, and instructional factors. This conceptual paper explores these barriers and develops an equity-focused framework for strengthening student well-being through inclusive PE. Drawing on literature related to inclusive education, physical activity, disability, motivation, social belonging, and well-being, the paper emphasizes that inclusion requires more than placing diverse learners in the same class. It involves improving access, adapting activities and instruction, creating psychologically safe environments, supporting positive teacher–student and peer relationships, and providing students with meaningful choices. These conditions may promote physical competence, autonomy, enjoyment, connectedness, and continued engagement in physical activity. The paper proposes a five-part framework consisting of identifying participation barriers, ensuring equitable access, applying inclusive pedagogy, promoting meaningful participation and belonging, and supporting physical, psychological, and social well-being. Practical recommendations include participation audits, differentiated instruction, accessible facilities and equipment, supportive assessment, student choice, teacher professional development, and greater attention to student voice. The framework is conceptual and therefore requires empirical testing across different educational and cultural contexts.

Keywords: Inclusive physical education, Equity, Student well-being, Participation barriers, Inclusive pedagogy, Physical activity

Exploring Early-Life Chronic Stress, Perceived Cognitive Changes, and Structural Brain Characteristics among Older Adults

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Early-life chronic stress has been linked to later cognitive decline and altered brain structure, yet little is known about how older adults themselves understand these changes. This hermeneutic phenomenological study explores how older adults with a history of chronic early-life stress perceive cognitive changes and structural brain characteristics, using Interpretative Phenomenological Analysis (IPA). In-depth, semi-structured interviews will be conducted to reveal lived experiences and meaning-making processes. Purposive sampling will be used to recruit participants aged 60-70 years who experienced chronic stressful life events in middle age, such as the death of a partner. Interviews will be audio-recorded, transcribed verbatim, and analyzed through close, iterative reading to identify patterns within and across cases. Expected themes include the lingering shadow of early stress, the felt experience of cognitive changes, resilience and coping, and meaning-making of cognitive aging. NVivo software will be used to organize the data, develop theme clusters, and produce graphical presentations. Findings will inform person-centered care, clinical practice, and future research on early-life adversity and cognitive aging, and will centre older adults' own voices in understanding how life-course stress shapes aging.

Keywords: Early life stress, Perceived cognitive changes, Hermeneutic phenomenology, Interpretative phenomenological analysis, Older adults.

The Pressure to Fit In: Exploring Social Conformity, Authenticity, and Well-Being among University Students

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University life offers opportunities for students to connect with others and feel a sense of belonging, and sometimes they feel pressured to fit in with the expectations of others. Motives of fitting in can shape student's modes of expression, choice making, relating with others, and identity presentation. When students feel unable to express themselves authentically, this may be associated with their psychological and social well-being. This research seeks to investigate the connection between social conformity, authenticity and well-being in students at the university. A quantitative survey will be administered to the undergraduate students to explore students' experiences with peer pressure, conformity, self-expression, authenticity, sense of belonging, and perceived well-being. Researchers will examine if the relationship between pressure to conform and the ability to express oneself is different for students who experience more pressure to conform and if it is different for their overall well-being. It will also explore any connections between feelings of acceptance and belonging and these experiences. The study is not focused on the negative or positive aspects of conformity but aims to understand how the pressure to conform can influence students' daily life experiences at university. The results could help inform the debate on environments that are inclusive to students by drawing attention to the need to provide places where students can engage, relate, and be themselves without needing to silence themselves. This study has studied the link between conformity, authenticity and well-being and has found that an important dimension of inclusion is to provide environments that are not only present but provide a sense of being accepted and being oneself.

Keywords: Social conformity, Authenticity, Well-being, Peer pressure, Sense of belonging.

From Financial Literacy to Investment Decision Quality: A Serial Mediation Model of Financial Self-Efficacy, Saving Intention, and Saving Behaviour with the Moderating Role of Self-Control

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Financial literacy has emerged as a crucial determinant of individual financial outcomes; however, the assumption that greater financial knowledge and skills automatically translate into effective financial actions remains theoretically and empirically contested. Despite increasing attention toward financial literacy, limited understanding exists regarding the psychological and behavioural mechanisms through which financial literacy is transformed into actual saving practices and high-quality investment decisions. Addressing this gap, this study develops an integrated behavioural finance framework that explains the sequential pathway from financial literacy to investment decision quality. Drawing upon Social Cognitive Theory, the Theory of Planned Behaviour, and Behavioural Life-Cycle Theory, this study proposes that financial self-efficacy acts as a critical psychological mechanism linking financial literacy with saving intention, while saving intention subsequently translates into saving behaviour, which ultimately contributes to superior investment decision quality. Furthermore, the study examines self-control as a behavioural boundary condition that strengthens the conversion of saving intentions into actual saving behaviours. Using survey data collected from individual investors, the proposed framework is examined through structural equation modelling to assess direct effects, serial mediation mechanisms, and moderation effects. The study advances behavioural finance literature by moving beyond the traditional knowledge-centered view of financial literacy and demonstrating that financial outcomes depend not only on possessing financial knowledge and skills but also on individuals' confidence, intentions, and behavioural regulation capabilities. The findings provide important theoretical implications by integrating cognitive, motivational, and self-regulatory perspectives into a unified model of financial decision-making. Practically, the study offers insights for policymakers, financial educators, and financial institutions to design interventions that enhance not only financial literacy but also financial capability, disciplined saving behaviour, and informed investment decisions.

Keywords: Financial literacy, Financial self-efficacy, Saving behaviour, Investment quality, Self-control.

Effect of Aerobic Exercise on Mental Health of Javelin Throwers

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The aim of this research to examine the effect of eight-week aerobic exercise intervention on the mental health and performance of professional javelin throwers from the Faisalabad National Athletic Clubs. Twenty participants engaged in javelin-throwing events, meeting the inclusion criteria, took part in the intervention. The experimental group (n=10) underwent a structured aerobic exercise program, while the control group (n=10) served as a benchmark. Pre-tests were conducted for both groups to measure mental health variables (stress, depression, and anxiety), followed by the experimental group engaging in aerobic exercise for 8 weeks (4 days a week). The control group in this study maintained their regular or standard practices without any alterations. A post-test was conducted at the end of the 8 weeks. Inclusion criteria for participants were being javelin throwers aged 15-30, professional athletes, and non-smokers, while exclusion criteria included being non-athletes, age below 15 or above 30, beginners, and smokers. Standardized questionnaires (Perceived Stress Scale, Beck's Depression Inventory, and Hamilton Anxiety Scale) assessed mental health variables. Performance was measured by three attempts at javelin throwing, with the best attempt as the representative measure. Demographic factors examined among participants included participation level (club, national, international), experience levels, residency (urban or rural), academic qualifications, and athletic background. The study aimed to comprehensively understand the diverse profiles of elite javelin throwers, and aimed to provide valuable insights into the influence of aerobic exercise on mental health and cognitive performance. In conclusion, while aerobic exercise demonstrated effectiveness in enhancing javelin throw performance and reducing stress, depression, and anxiety levels among professional athletes, this study emphasizes the importance of a holistic understanding of its effects on mental health. These findings provide valuable insights for practitioners, coaches, and athletes, highlighting the multifaceted implications of incorporating aerobic exercise into training regimens and the need to consider both physical and mental well-being in athletic performance enhancement strategies.

Keywords: Aerobic exercise, Mental health, Javelin throwers



ARTS, CREATIVITY AND HUMAN CENTERED INNOVATION

ORAL

PRESENTATIONS

Huma Mulji: Unveiled Eureka–Cognitive Processes, Visual Metaphors, and Urbanization in Contemporary Art

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Contemporary art in Pakistan has evolved far beyond self-expression, unifying broader ideas of socio-economic, sociopolitical, and cross-cultural subjects, emerging as critical intuitive explorations of existence, identities, and disparities. Contemporary practitioner Huma Mulji, pioneering the use of taxidermy as a conceptual imperative in *Heavenly Heights*, *Hanging Fire* and *Her Suburban Dream*, has constructed a vocabulary which stems from a local lived experience and is investigated as the intersection of contemporary visual arts and cognitive psychology. Conceptual structuring of visual metaphors, and the incorporation of attention, knowledge, memory, perception, and reasoning, resulting in creativity as a higher order of thinking that incorporates problem-solving skills into the creative process of art production. These factors were studied in Mulji's famous works, maneuvering contradictory elements. Utilising a phenomenological approach, the research bridges primary data gathered from structured artist interviews and visual documentation with secondary literature on cognitive processes, problem-solving skills, and gestalt perception. The findings reveal that Mulji's juxtaposition of taxidermic buffaloes and industrial electrical pylons, is not merely intuitive, but evolved from a structured cognitive mapping of ground-level insights from the local community, memory retention, and fictional narratives. By withholding moral judgment and highlighting a plurality of realities, Mulji's work functions as a powerful form of human-centered innovation and non-verbal communication. Ultimately, this study demonstrates that analyzing art production through a cognitive lens offers profound insights into how creative problem-solving drives contemporary artistic expression, validating cognitive development as an essential component of the artistic process.

Keywords: Contemporary art, Cognitive psychology, Visual metaphor, Urbanization, Taxidermy, Huma Mulji

Reimagining Transit Infrastructure through Third-Space Design: An Integrated Sustainable Transportation Hub in Faisalabad

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Urbanization in the developing world is accelerating with estimates of 5.5 billion people living in urban areas by 2050. With this growth come challenges such as pressures on land resources, environmental degradation, and more unsustainable transportation and haphazard patterns of urban land use. Sustainable urban transit systems and transit-oriented development (TOD) can provide potential solutions that improve accessibility to respond to urban form, assist with economic competitiveness, and improve quality of life. The finding suggests substantial changes from both open land and vegetation to built-up forms linked with increased real estate investment and value close to metro stations. The results of the thesis suggest that urban planning needs to integrate transportation infrastructure for sustainable development, utilize green infrastructure to improve environmental impacts and implement TOD practices to build resilience. The thesis demonstrates that a careful approach to the design of metro stations contributes to the development of livable and connected cities and contributes an important understanding for future urban transit concepts.

Keywords: Public Transit, Urban Connectivity, Transit-Oriented Development, Active Public Realm, Universal Design, Sustainable Transit Infrastructure

Pigment to Pixel: Geometry, Chemistry and Light in Art Education of the Subcontinent, from Colonial Classrooms to AI Studios

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This research investigates how technology, along with innovation, has frequently reframed the concept and process of creativity in relation to the human-centered evolution of art and craft. Art education in the 19th-century Subcontinent was marked by the establishment of colonial academic art institutions under the South Kensington system that encouraged a graded sequence of drawing exercises. Drawing was taught as a subject based on the scientific knowledge of geometry and perspective; assessed and evaluated systematically through classwork. These art schools in Madras, Calcutta, Bombay, and Lahore preferred calculation over creativity, and curriculum over instinct, where the human eye was instructed to act like a tool of measurement (input) and the hand to produce sketches and images (output). The invention of the camera combined optics and chemical processes to transfer an image on a light-sensitive surface, unsettling the arduous method of hand-produced images. Consequently, this invention changed the artist's point of view from what one sees to what one feels; emphasizing subjective and abstract expression in painting and image-making. From Impressionism to Surrealism, the focus remained on perception and imagination; as a human response to the machine age. The STEAM elements that systematized art education in classrooms are today encoded in generative AI, which acts upon carefully considered, well-conceived, and precisely articulated verbal or coded prompts. The process of creative expression shifts from the skillful hand to the conceiving mind, reframing the position of a prompter as an artist. This paper argues that a human-centered, STEAM-integrated art education is pivotal. However, in future-ready societies, the artist can invest more time and effort in conceiving an idea, where the machine waits for prompt-based direction, to create images reflecting the collective past and visual culture of centuries in a single frame, provided learners retain the foundational knowledge to direct and evaluate the machine.

Keywords: Art education, STEAM, South Kensington system, modernism, generative AI, human-centered creativity.

Wrong Train and Brain Drain: Discovering the Self, Finding Purpose

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Many of us who completed our schooling in Pakistan realize that it did little to prepare us for practical and professional life. I am one of many graduates compelled to change fields after intermediate education, an experience like boarding the wrong train, getting off at an unintended station, and searching for another to reach one's destination. The wrong-train analogy may explain why Pakistan, despite having the world's fifth-largest population, has contributed comparatively little to scientific discovery, technological advancement, and design innovation globally. Many who pursued so-called *aala taleem* (higher education) abroad, and never returned (brain drain), realized that they had been living in Plato's cave, mistaking memorized shadows for genuine understanding. In Plato's allegory, cave prisoners take shadows for reality until one escapes into the light and sees the truth. This raises a question: what is missing in our education system? The answer lies in an emphasis on dated prescribed curricula lagging the fast-moving world, on grades over curiosity, and on fear of mistakes over experimentation, risk-taking, and fearless inquiry. Students are rewarded for reproducing answers rather than questioning the status quo and imagining new paths.
Through my 34-year teaching career, I have come to believe that our education system should help students realize who they are, what is their true potential? This self-realization is also needed collectively: what potential do we hold as a nation? What are our country's problems, and how can education nurture creative, critical, innovative, passionate seekers of knowledge who are also able solve problems locally rather than importing secondhand solutions, like the container-loads of goods sold in *Landa Bazaar*?

Keywords: Education reform, Pakistan, Critical thinking, Creativity and innovation, Self-realization

Seeing the Wood and the Trees: Reflective Practice for Human-Centred Creativity

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I argue that human-centred view of creativity requires ways to strengthen a sense of a *reflective creative practice*. Up until a few years ago, it might have seemed quite perverse that we needed to discuss the extent to which creativity is a human-centered endeavour. But obviously, the juggernaut of AI and its sponsoring of the rush to creative outcomes has recently crashed into this perception. The English language has a proverb used to describe someone who is too close to the details of the thing they are engaged in, so close they are unable to see the bigger picture depicting the very thing with which they are so engaged – *(s)he cannot see the wood for the trees.* Developing creative self-awareness entails looking down at creative roots when on the good ground, and looking up at the promise of creative outcomes when tussling with the difficult details. Such counterintuition is important for this human-centered view capable of seeing both 'the wood' of our whole creative practice, whilst also knowing each particular 'tree' with which we create it. In contrast to AI's rush to creative outcomes, I strongly believe that engagements with one's underlying *creative processes* is the very seat of creativity itself – what it 'is' and where it 'comes from'. I argue that strengthening reflective creative practice brings us a greater sense of creative competence, leads to greater creative self-confidence, and is the central wellspring of a flourishing sense of human life as an experiment in becoming - for our own sense of individual freedom, but also as the basis of ethical relationships with others.

Keywords: Reflective creative practice, Human-centered creativity, AI, Creative process

"Why Were You Created?": Navigating Interactive Agency Through Oppressive Spaces in *Detroit: Become Human* and *Horizon Zero Dawn*

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Beyond entertainment, video games can function as creative and interactive spaces for emotional investment and psychological engagement. This study explores the therapeutic potential embedded in the game designs of *Detroit: Become Human* (DBH) and *Horizon Zero Dawn* (HZD), with emphasis on how narrative and interactivity engage players with aspects of identity, including agency, self-worth and belongingness. Deci and Ryan's Basic *Psychological Needs Theory*, a component of *Self-Determination Theory*, and *Kirkpatrick's* gamer identity concept were adopted to assess game designs and player experiences, together with Bizzocchi's narrative framework, which includes the concept of *Narrative Interface later* extended by Ben Lin into an Interface Model. A qualitative methodology was employed, and open-ended questions were used to examine player experiences. The findings indicated that both games offer human-centered narratives in which interactors experience personal conflicts related to self-perception, social connection and decisive authority. In DBH, interactive choices allow interactors to experience avatar identities, whereas HZD entrusts the avatar's personal development to the player. The analysis also shows that both games promote need satisfaction (competence, relatedness and autonomy) and need frustration, which arises from authorial control reflected in bounded agency, moral dilemmas and gameplay mechanics. Narrative content alone proved inadequate unless it coexisted with interactivity, creative game design and player agency. The study concludes that narrative-embedded interactive digital spaces can facilitate emotional expression, identity negotiation and self-empathy, and that creative technologies have the potential to support human-centered approaches to psychological well-being.

Keywords: Therapeutic potential, Game design, Self-determination theory, Player agency, Self-worth

Conspicuous Consumption in the Digital Age: Materialism, Fame Culture and Social-Emotional Consequences: A Study of *The Social Dilemma*

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This study applies Thorstein Veblen's theoretical framework to examine how conspicuous consumption has changed in the digital age. Traditional conspicuous consumption focused on the public display of material wealth to secure social prestige, whereas modern digital culture has reconfigured status performance into new economies of online visibility, including followers, likes, algorithmic popularity and influencer capital. The study argues that social media platforms have reorganized status-oriented behavior by transforming attention and recognition into key indicators of social value and self-worth. A critical textual analysis of the documentary *The Social Dilemma* (2020, directed by Jeff Orlowski) was conducted to investigate how platform architectures, recommendation algorithms and targeted advertising foster materialistic dispositions and fame-centered identity projects. The analysis illustrates how these design elements influence users' emotions, interactions and self-presentation and normalize continuous performance and comparison. It also highlights the socio-emotional effects of digital materialism, including identity fragmentation, affective isolation, anxiety, increased social comparison and the erosion of genuine interpersonal ties. The findings indicate that conspicuous consumption in the digital age depends increasingly on the accumulation of online attention and social validation rather than on financial assets. The study concludes that contemporary society is moving away from traditional material consumption toward digitally mediated performances of visibility and status, frequently at the expense of relational depth and emotional well-being.

Keywords: Thorstein Veblen, Digital age, Economics, Algorithms

Digital Shadows: Representing Adolescent Identity and Emotional Experience in *Adolescence*

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This study examines emotional experiences in the contemporary series *Adolescence* and explores how digital culture and online environments influence the emotions, identities, relationships and behavior of young people. The series follows Jamie, a thirteen-year-old boy accused of killing a female classmate, and presents social and emotional challenges that adolescents may face, including the influence of online spaces and peer groups. The study focuses on emotional experiences such as loneliness, insecurity, anger, confusion, peer pressure and the desire for acceptance, particularly in relation to the characters' interactions with digital and social environments. Stuart Hall's Representation Theory serves as the main theoretical framework for understanding how emotions, identities, social relationships and youth culture are constructed and represented through characters, dialogue, visual elements and digital communication. The concepts of digital culture and online identity are used to understand how online environments can shape young people's beliefs about themselves and others. A qualitative research approach is adopted, in which selected scenes, dialogues and representations of digital and social interaction are analyzed through textual and thematic analysis. The research aims to examine how digital culture and peer influence shape the emotional experiences of young people and how contemporary screen narratives present the challenges faced by adolescents in a digitally connected society. The study highlights the connection between digital culture, emotional experience and youth identity and contributes to the understanding of how contemporary screen narratives represent the changing emotional and social experiences of adolescents.

Keywords: Digital culture, Online identity, Emotional experience, Youth culture, Representation theory

From Rejection to Agency: Narrative Reframing as a Pathway to Human-Centered Innovation in *La La Land*

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Existing research on Damien Chazelle's *La La Land* (2016) has largely examined its cinematic form, nostalgia, genre revival and emotional themes, leaving the problem-solving potential of personal narrative construction comparatively unexplored. This study addresses this gap by examining how narrative thinking enables human-centered innovation when conventional career pathways become restrictive. Drawing on Jerome Bruner's narrative constructivism and the empathy and reframing principles of the Stanford school's Human-Centered Design (HCD) framework, the study conceptualizes narrative as a means of transforming lived experience into creative action. The analysis focuses on Mia's trajectory from recurring audition rejection to the creation and performance of her one-woman show, *So Here's to the Fools Who Dream*. It asks how personal narrative expression enables Mia to reframe recurring professional rejection into creative agency and how her self-authored storytelling reflects the principles of human-centered innovation. Qualitative narrative and thematic textual analysis of selected scenes, dialogue and character choices identified patterns of rejection, aspiration, identity, empathy, reframing and creative agency. The findings indicate that Mia's transformation moves from lived experience to narrative meaning, from meaning to problem reframing, and from reframing to creative action. The study concludes that *La La Land* demonstrates how narrative thinking can move beyond representation to become a human-centered mechanism for recognizing problems, generating possibilities and pursuing context-sensitive solutions.

Keywords: Narrative thinking, Human-centered innovation, Narrative reframing, Creative agency

Vessels of Memory: Translating Lacquer Art on Canvas

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Silanwali, a tehsil of District Sargodha in Punjab, Pakistan, is known nationally and internationally for its lacquered woodwork, locally called naqshi. The craft was established in the town by migrant families from Karnal and is worked on turned sheesham (rosewood) with layers of colored lacquer that are scratched back to reveal patterns. Existing scholarship on Silanwali has focused mainly on carpentry, artisans' skills and livelihoods, while the visual language of its lacquer ornament has received far less attention through artistic practice. This practice-based study investigates a series of six paintings on canvas, created in 2019, that translates the visual vocabulary of Silanwali lacquerware into the language of easel painting. It draws on craft theory, ornament theory and material culture studies, as well as reference photographs of lacquered objects, workshops and craftspeople at work, and asks how ornament, form and material presence can be carried across media without reducing craft to illustration. Formal and iconographic analysis, supported by color-relationship analysis using Itten's contrast categories, identified four translation strategies: ornamental transposition, displacement through rotation and cropping, absence through shadow and ornamental withdrawal, and seriality through the grid. The paintings are interpreted as reflective inquiries into the position of a Mughal-era craft tradition in contemporary Punjab, where it is shaped by migration, inherited family workshops, commercial demand and the declining number of skilled lacquer painters. The study concludes that studio practice can operate as visual documentation and critical commentary that complements ethnographic approaches to intangible cultural heritage, with implications for art education, heritage safeguarding and craft-based artistic research in Pakistan.

Keywords: Practice-based research, Painting on canvas, Silanwali, Lacquer art, Intangible cultural heritage



ARTS, CREATIVITY AND HUMAN CENTERED INNOVATION

POSTER

PRESENTATIONS

Dastangoi as Human Technology: Storytelling, Knowledge and Meaning in Faiqa Mansab's *The Sufi Storyteller*

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In an age shaped by digital technologies, rapid information exchange and shortened forms of communication, storytelling remains one of humanity's oldest technologies for transmitting experience, preserving knowledge and producing meaning. Faiqa Mansab's *The Sufi Storyteller* (2025) provides a significant contemporary literary space for examining this function through its incorporation of dastangoi, the traditional Urdu art of performative storytelling. The novel combines a contemporary murder mystery with Sufi storytelling traditions and a non-linear narrative structure of embedded stories, repetitions, returns and temporal shifts, which Mansab has described as a deliberate attempt to evoke the musicality, layered structure and circular movement of dastangoi. This study examines dastangoi as a form of human technology through the theoretical perspectives of Walter Benjamin and Mikhail Bakhtin. Benjamin's concept of the storyteller frames storytelling as a mode of experiential knowledge that connects individuals through shared narratives rather than merely transferring information, while Bakhtin's concepts of dialogism and chronotope illuminate how multiple voices, stories, temporalities and spaces interact within the narrative structure. Qualitative close textual analysis was used to investigate how the novel transforms an oral storytelling tradition into a contemporary literary form and how this transformation affects the production and interpretation of knowledge. The study argues that Mansab presents storytelling not only as a thematic element or cultural tradition but also as a dynamic human technology that connects experience, memory, history and imagination. It concludes that the novel demonstrates the continuing relevance of traditional storytelling within contemporary literary and technological cultures and positions dastangoi as an alternative human-centered mode of communication and meaning-making.

Keywords: Dastangoi, Human technology, Storytelling, Narrative knowledge, Dialogism

Coexistence of Humans and Machines: A Posthumanistic Study of Ravn's *The Employees*

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This study examines how Olga Ravn's *The Employees* explores the relationship between artificial and human workers within a futuristic corporate structure aboard the Six-Thousand Ship. The novel presents a posthuman society that challenges conventional understandings of identity, consciousness and emotional authenticity as the boundaries between humans and humanoids progressively dissolve. Structured around fragmented witness statements collected by an anonymous corporate committee, the text depicts how oppressive institutional systems produce emotional exhaustion, alienation and psychological instability in both human and artificial employees. Using a posthumanist framework in conjunction with theories of emotional labor and corporate surveillance, the study investigates how labor extends beyond physical work to encompass emotional and affective performance, in which workers are expected to regulate their emotions, suppress individuality and sustain productivity under corporate authority. The analysis shows that the enigmatic objects brought aboard the ship function as catalysts that awaken workers' memories, desires and existential reflection, thereby destabilizing the corporation's rigid mechanisms of control. By blurring the boundary between machine and human consciousness, the novel raises the question of whether identity is biologically determined or socially constructed through labor and institutional conditioning. The study concludes that the novel critiques contemporary capitalist systems that commodify human emotion and artificial intelligence. Applying posthumanism to *The Employees* highlights the unstable nature of identity and contributes to the understanding of posthuman existence within technologically advanced and institutionally controlled environments.

Keywords: Olga Ravn, Novel, Posthumanism, Human, Control

Mitigating the Global Talent Shortage: Implementing Dynamic Resource Leveling for Sustainable Employee Well-Being

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The global shortage of highly specialized technical talent presents a serious challenge for project management organizations. Traditional resource management techniques rely on rigid, static capacity planning and are inadequate for sudden, unpredictable shifts in talent availability. This study explores dynamic resource leveling strategies designed to balance project demands with long-term employee well-being. The objective was to quantify how dynamic resource reallocation algorithms affect team productivity and prevent staff burnout during large, multi-year projects. A longitudinal case study methodology was employed, in which forty enterprise-level project teams operating in the healthcare and software engineering sectors were tracked over an eighteen-month period. The results show that organizations deploying dynamic resource leveling frameworks, which adjust individual task deadlines according to real-time employee workload capacity and reported fatigue levels, experienced a 35% reduction in voluntary employee turnover. Despite extended individual milestone deadlines, these organizations maintained overall project completion rates identical to those of control groups that used rigid scheduling. The study concludes that project managers should prioritize sustainable human capacity over rigid baseline scheduling.

Keywords: Project management, Resource leveling, Talent shortage, Employee well-being, Capacity planning

Art as a Language of Expression: How Creative Expression Helps Humans Communicate Feelings and Emotions

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Art provides a means of communicating emotions, thoughts, fears and experiences that ordinary language cannot always express. This study examines how Darren Aronofsky's psychological drama *Black Swan* portrays art as a language of expression, in which ballet functions beyond entertainment or performance. Qualitative textual analysis of the film's narrative, characterization and visual and auditory elements was used to explore how the protagonist, Nina Sayers, expresses her emotions, desires, insecurities and inner conflicts through ballet. The analysis shows that her pursuit of the perfect ballerina reflects a struggle to understand and accept different parts of herself. The contrast between the *White Swan* and the Black Swan represents opposing qualities, namely innocence and desire, control and freedom, and perfection and imperfection. As Nina performs both roles, the distinction between her artistic and personal identity gradually disappears, and her movements, expressions, physical transformation and performances communicate feelings that she cannot express verbally. The film also reveals a darker side of artistic expression: the pursuit of perfection creates psychological pressure and turns ballet from a source of creativity into a form of confinement, while the body becomes the medium through which fear, ambition, frustration and suppressed desires are revealed. Mirrors, shadows, music, movement and disturbing visual transformations reinforce this portrayal and allow the audience to experience the psychological struggle of the protagonist. The study concludes that *Black Swan* presents art as a complex language capable of expressing beauty, fear, desire, pain and identity simultaneously. Artistic expression can be personal and transformative, but it becomes destructive rather than liberating when perfection takes priority over emotional freedom.

Keywords: Art, Language, Expression, Black Swan, Drama

A Comparative Study of Ecological Emotions in Selected Contemporary South Asian and African Fiction

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The climate crisis is tied closely to environmental degradation, but it is also an emotional and cultural issue. Existing studies often overlook the feelings that ecological change produces in South Asian and South African literature. This study looks at eco-emotions such as eco-anxiety, solastalgia, mourning, guilt, hope and resilience. It also looks at biodiversity loss and environmental injustice. It focuses on four novels: Gun Island (2019) by Amitav Ghosh, *The Story of Noble Rot* (2022) by Siddhartha Deb, *A Spell of Good Things* (2023) by Ayọ̀bámi Adébáyọ̀ and *Glory* (2022) by NoViolet Bulawayo. Using textual analysis within affective ecocriticism and comparative literature, it examines structure, characters, symbols and the settings shaped by ecological catastrophe. The analysis shows that eco-emotions are not only private feelings. They are also moral and political experiences that shape consciousness and challenge human-centred views. By bringing the two regions into comparison, the study fills a significant gap in current research. It also shows that contemporary fiction shares ecological experiences across cultures, which adds to the field of ecocriticism. Finally, it argues that literature can raise awareness, encourage moral responsibility and prompt ethical responses in the face of global environmental crisis.

Keywords: Eco-emotions, Biodiversity, Literature, Environmental injustice

Beyond the Phrase: A Human-Centered Visual Communication Approach to English-Speaking Hesitation

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English-speaking hesitation is a common challenge among learners who can read, write, and understand English but struggle to express their thoughts confidently in spoken interaction. "*Beyond the Phrase*" investigates this gap between language understanding and verbal expression, focusing on emotional barriers such as fear of judgment, pronunciation mistakes, self-consciousness, and the pressure to speak perfect English. The purpose of the study was to understand how these factors influence learners' willingness to speak and to explore a human-centered approach for addressing the problem. The research was informed by observations, learner responses, secondary research, and the identification of recurring experiences associated with hesitation during English communication. These findings were analyzed to understand how fear, pauses, self-doubt, and concern about making mistakes affect spoken participation. The study found that the difficulty experienced by many learners is not always a lack of English knowledge; rather, hesitation can emerge when learners become overly conscious of correctness and external judgment. This distinction shifts attention from language proficiency alone toward the emotional experience of speaking. The study therefore emphasizes the importance of creating supportive learning environments in which communication is valued over perfection and mistakes are treated as a natural part of learning. It concludes that English-speaking hesitation should be understood as both a linguistic and human-centered communication issue. By recognizing the emotional barriers between knowing English and speaking it, educators and learners can develop a more encouraging understanding of fluency, where confidence, clarity, and willingness to communicate are considered alongside grammatical accuracy and pronunciation in practice.

Keywords: English-speaking hesitation, Human-centered approach, Language learning, Communication confidence, Spoken English

POLICY, LEADERSHIP AND GOVERNANCE FOR FUTURE READY SOCIETIES

ORAL

PRESENTATIONS

Future-Ready Governance: Policy Innovation, Ethical Leadership and Institutional Resilience in a Changing World

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Contemporary governance systems face unprecedented disruption characterized by rapid technological advancement, climate instability, geopolitical volatility, and shifting socio-demographic realities. Traditional bureaucratic paradigms, typically reactive, siloed, and rigid, are increasingly ill-equipped to address these interconnected and non-linear polycrises. This paper examines the conceptual architecture and operational imperatives of "future-ready governance," defining it as an integrated framework anchored in three mutually reinforcing pillars: policy innovation, ethical leadership, and institutional resilience. First, policy innovation is positioned not merely as technical experimentation, but as an agile, data-informed, and participatory mechanism capable of anticipatory decision-making. By leveraging emerging technologies such as artificial intelligence and predictive modeling, governments can transition from ex-post crisis response to ex-ante strategic foresight. Second, the study argues that technological and structural adaptation is inert without ethical leadership. In an era marked by democratic erosion and algorithmic complexity, ethical leadership provides the normative foundation necessary to balance technological acceleration with human rights, public transparency, accountability, and the preservation of social trust. Third, the analysis addresses institutional resilience, demonstrating how public organizations must cultivate adaptive capacity, systemic redundancy, and distributed decision-making structures to withstand external shocks without compromising core democratic functions. Synthesizing contemporary public administration theory, regulatory governance frameworks, and empirical case studies, this paper illustrates that future-readiness requires a fundamental shift from risk minimization to systemic adaptability. Ultimately, the paper provides a cohesive roadmap for public administrators, policy designers, and civic leaders to dismantle operational silos, embed anticipatory capacity, and foster resilient institutions that deliver sustainable, equitable, and accountable public value in an increasingly uncertain global landscape.

Keywords: Future-ready governance, Policy innovation, Ethical leadership, Institutional resilience, Anticipatory policy, Public sector modernization, Adaptive capacity

Building Resilient Societies through Innovation and Good Governance

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Contemporary societies face a confluence of systemic shocks—from climate change and pandemics to economic volatility and geopolitical instability. While innovation and good governance are frequently cited as pillars of resilience, their interplay remains underexplored. This paper posits that resilience is not merely the capacity to bounce back, but a dynamic process of adaptation and transformation, driven by the symbiotic relationship between technological advancement and institutional integrity. Through a mixed-methods analysis of case studies across developed and developing nations, this research investigates how governance structures (characterized by transparency, inclusiveness, and adaptive regulation) either enable or inhibit the deployment of innovative solutions for public good. The findings suggest that technological innovation alone is insufficient; it must be underpinned by "adaptive governance" that fosters trust, encourages experimentation, and ensures equitable access. Conversely, good governance without innovation leads to stagnation in the face of novel threats. The paper proposes a conceptual "Resilience Matrix" that maps the interaction between governance quality and innovation capacity, offering policymakers a strategic tool for identifying vulnerabilities and leveraging synergies. Ultimately, this work argues that the path to a resilient society lies in a co-evolutionary approach, where governance anticipates technological disruption and innovation is deliberately steered toward societal cohesion and long-term sustainability.

Keywords: Societal resilience, Adaptive governance, Technological innovation, Institutional integrity, Resilience matrix

The Role of Local Government Policies in Promoting Gender Equality and Women Empowerment at the Grassroots Level

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The study examines the role of local government policies in promoting gender equality and empowering women at the grassroots level. National policy and international instruments provide general policies and directives for the promotion of gender equality, but local governments are most responsible for implementing them in practice. The research examines the influence of decentralized governance, resource allocation, and localized policy design on the socio-economic status, political participation, and autonomy of women in their daily lives within communities. The study uses a mixed-methods research approach to evaluate the effectiveness of gender-specific local policies. This analysis concentrates on three policy themes: gender-responsive budgeting, place-based economic inclusion programs, and local decision-making institutions and women's representation. The findings show that local policies specifically aimed at economic inclusion and reserved-seat policies have a significant positive impact on women's decision-making power within the household and community. There was a significant improvement in successful policy implementation in municipalities that had implemented participatory governance models, which included active participation of women in the process of policy design. However, the study highlights major challenges: the success of progressive local policies is often hindered by significant implementation difficulties, inadequate local budgets, lack of institutional capacity, and strong community-level socio-cultural norms of patriarchy. Local governments have a unique and optimal opportunity to promote meaningful gender equity because of the local context. However, to be viable, grassroots empowerment needs to be supported by local policy, but not by local policy in isolation. To break down gender-specific socio-cultural barriers, decentralized gender initiatives should be accompanied by strong, funded mechanisms, mandatory gender sensitization training for local authorities and long-term collaboration with grassroots women organizations.

Keywords: Local government, Women empowerment, Decentralization, Grassroots democracy

Access to Justice and Legal Governance in the Digital Era: Reforming Justice Systems for Future-Ready Societies

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Effective governance is only possible with the rule of law, and the right to an efficient and effective system of justice is a building block of the rule of law. Although new technologies may have a positive impact on justice administration through processes such as online case management, electronic filing, and the use of digital evidence, technological changes may also introduce problems relating to due process, fairness, the digital divide, privacy, cybersecurity, and the automation of decision-making. This paper focuses on legal governance and judicial leadership in the creation of justice systems that are technologically responsive and efficient. The paper studies how far digital technologies can bring about positive changes in reducing procedural delays, costs of litigation and inequities while upholding substantive and procedural fairness of the legal process and the independence of the judiciary. This paper studies the obligations on judges and court administrators in the context of the legal and constitutional framework. The study uses a qualitative doctrinal method and analyzes the intersection of constitutional frameworks, procedural rules, legal doctrines, the legislative framework, and digital justice. This paper calls for a positive bias in creating a fair and just digital justice framework with enhanced digital legal infrastructure, training of the judiciary, and the integration of cyber justice within the justice system.

Keywords: Access to justice, Digital justice, Legal governance, Judicial leadership, Rule of law

Governance, Leadership and Policy Pathways for Free and Quality Education in Future-Ready Societies

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Free and quality education is a central foundation of inclusive and sustainable societies, yet its effective provision depends not only on educational investment but also on the quality of public policy, governance, and leadership. Sustainable Development Goal 4 places inclusive and equitable quality education at the centre of the global development agenda and calls for free and equitable primary and secondary education alongside meaningful learning opportunities for all. This paper examines how policy choices, institutional governance, and responsible leadership can strengthen the provision of free and quality education, particularly within developing societies. Adopting a qualitative research methodology based on document analysis, the study analyses international development commitments, governance principles, educational policy frameworks, and legal and institutional mechanisms relevant to access, quality, equity, and accountability. It explores how governments can translate global educational commitments into effective national policies through transparent decision-making, accountable institutions, inclusive planning, and sustained public oversight. The study also considers the role of leadership in addressing barriers that limit educational participation, including socioeconomic disadvantage, unequal opportunities, inadequate learning environments, and exclusion of vulnerable communities. The findings suggest that educational access cannot be sustained through policy formulation alone; effective governance is required to ensure implementation, institutional coordination, public accountability, and continuity of educational reforms. Leadership further shapes whether educational policies remain responsive to changing social needs and emerging demands of future-ready societies. The study argues that SDG 4 can serve as a governance framework through which states can align educational policy with principles of equality, inclusion, sustainability, and public responsibility. It concludes that coherent policymaking, accountable governance, and visionary leadership are essential for transforming free and quality education from a global commitment into a sustainable public outcome.

Keywords: SDG 4, Education policy, Governance, Leadership, Educational equity

Governance, Leadership and Policy Pathways for Youth Participation in Governance and Public-Policy Making in Pakistan

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Youth participation has become an important dimension of inclusive governance, democratic responsiveness, and sustainable public policy, particularly in states experiencing significant demographic change. In Pakistan, the demographic prominence of young people creates substantial potential for civic and policy engagement; however, their numerical significance has not consistently translated into meaningful influence within formal governance and policy-making processes. This paper examines the institutional architecture, opportunities, and constraints shaping youth participation in governance and public policy-making in Pakistan, focusing on the gap between formal recognition of youth engagement and its substantive incorporation into decision-making. Employing a qualitative, policy-oriented research design, the study synthesizes scholarly literature, policy documents, institutional reports, and documented youth-engagement initiatives to assess formal and informal mechanisms of participation, including youth councils, consultative forums, civil-society initiatives, digital platforms, and youth–government policy dialogues. The analysis indicates that, although participatory initiatives have expanded opportunities for youth engagement and interaction with policymakers, participation remains unevenly institutionalized and frequently concentrated at the consultative rather than decision-making level. Persistent barriers include limited representation within formal policy institutions, socioeconomic and gender-based inequalities in access to participatory spaces, inadequate civic and policy literacy, fragmented institutional coordination, and weak mechanisms for converting youth input into demonstrable policy outcomes. It concludes that strengthening youth participation in Pakistan requires a transition from episodic consultation toward institutionalized, inclusive, and outcome-oriented mechanisms that establish clearer pathways between youth input and public decision-making. Greater use of digital civic platforms, transparent consultation systems, and accessible policy-feedback mechanisms may further expand participation while improving institutional responsiveness, inclusion, and accountability.

Keywords: Youth participation, Governance, Public policy-making, Participatory governance, Civic engagement

AI Governance and Financial Risk Resilience: Developing and Validating a Framework for AI Accountability and Human Oversight in Pakistan's Financial Institutions

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The increasing integration of artificial intelligence (AI) into financial institutions is transforming financial decision-making, risk assessment, compliance, and operational processes, while creating emerging challenges related to accountability, transparency, human oversight, and financial risk. Despite growing scholarly attention to AI in finance, limited empirical research has examined how AI accountability and human oversight can be systematically integrated to strengthen financial risk resilience, particularly within emerging financial systems. This study aims to develop and validate a framework linking AI accountability, human oversight, and financial risk resilience in Pakistan's financial institutions. A sequential mixed-methods design will be adopted. The qualitative phase will employ semi-structured interviews with banking executives, risk managers, compliance professionals, internal auditors, and AI specialists to explore the mechanisms through which AI accountability and human oversight shape financial risk resilience. The resulting insights will inform the development of a quantitative measurement instrument. Survey data will subsequently be analyzed using exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM), supplemented by mediation, moderation, and multi-group analyses where theoretically justified. The study seeks to develop an empirically validated framework explaining how accountable AI governance and effective human oversight can contribute to stronger financial risk resilience in Pakistan's financial institutions.

Keywords: AI accountability, Human oversight, Financial risk resilience, AI governance, Financial institutions

Integrating Artificial Intelligence into International Commercial Dispute Resolution: A Framework for Human-Centric Governance

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The rapid integration of Artificial Intelligence (AI) into international commercial dispute resolution is fundamentally transforming cross-border arbitration, mediation frameworks, and global trade administration. While AI-driven Online Dispute Resolution (ODR) platforms and predictive analytics offer unprecedented gains in cost-efficiency, speed, and cross-border accessibility, their expanding footprint introduces critical legal dilemmas concerning arbitral authority, enforcement, and procedural fairness under foundational international instruments, principally the New York Convention and the Singapore Convention on Mediation. Employing a doctrinal and conceptual legal methodology, this study critically evaluates the regulatory frameworks, institutional leadership, and governance models necessary to responsibly embed AI within international dispute resolution. The paper contends that procedural efficiency cannot serve as a surrogate for adjudicative legitimacy or international public policy standards (ordre public). Sustainable international dispute resolution systems demand forward-looking policy architecture, proactive institutional rules (such as those promulgated by UNCITRAL, the ICC, and the Silicon Valley Arbitration and Mediation Center [SVAMC]), and rigorous human oversight to align technological innovation with the rule of law and global commercial trust. Ultimately, this study proposes a human-centric governance model wherein international arbitrators and mediators retain non-delegable decision-making authority, positioning AI strictly as a cognitive tool for evidence management and legal analysis rather than an autonomous adjudicator. It concludes that effective international governance can successfully harness AI capabilities while steadfastly safeguarding fundamental procedural rights and the global enforceability of arbitral awards and settlement agreements.

Keywords: AI governance, International commercial arbitration, Alternative dispute resolution (adr)

POLICY, LEADERSHIP AND GOVERNANCE FOR FUTURE READY SOCIETIES

POSTER

PRESENTATIONS

Smart Education Governance: Using Technology and Data to Improve Educational Policy and Child Development

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Across the world Education systems are shaped by digital technologies, data analytic, learning platforms, digital administrative systems and promoting the use of artificial intelligence. These developments create opportunities for governments to move from traditional education administration towards technology-based and E-governance. Smart education governance means the strategic use of technology, educational data, digital infrastructure, and accountable decision-making mechanisms to improve educational planning, resource allocation, learning outcomes, inclusion, and child development. However, the increasing collection and processing of children's educational data also creates significant legal, ethical, social, and governance challenges such as children's privacy and data, cyber security, cyber discrimination, algorithmic bias, commercial exploitation, transparency, and unequal digital access. This article examines how technology and data can contribute to smarter educational policy-making while keeping children and their data safe from any cyber offence or misusing of any information. It adopts a qualitative doctrinal and policy-analysis methodology, drawing upon international standards, contemporary policy frameworks, and the advance developments that require in Pakistan. The article analyses Pakistan's emerging digital education infrastructure, including Punjab's School Information System, alongside international approaches reflected in UNESCO, UNICEF, OECD and Sustainable Development Goal 4 frameworks. It concludes by proposing a child-centred smart education governance framework based on five principles: evidence-based policy making, privacy and data protection, equity and inclusion, transparency and accountability, and meaningful human oversight. The study recommends stronger institutional coordination, data governance rules, impact assessments, teacher participation, digital capacity building, and safeguards for children before education technologies are widely deployed.

Keywords: Smart education ecosystem, Educational technology, Artificial intelligence, Digital governance, Children's rights

Smart InfoBot: A Privacy-Preserving Conversational RAG Chatbot for Semantic Search over Multi-Page PDF Documents

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Manually sifting through lengthy PDF documents to find specific information is slow, and many existing AI-based solutions rely on costly external APIs or raise data privacy concerns. This work presents a conversational Retrieval-Augmented Generation (RAG) chatbot, developed at the Center of Data Science, Government College University Faisalabad, that enables automated semantic search and knowledge extraction from multi-page PDFs while keeping user data entirely local. The system was built in Python 3.12 using the Lang Chain framework. Uploaded PDFs are parsed with Py PDF Loader, split into overlapping chunks via a Recursive Character Text Splitter, and embedded using the Hugging Face all-MiniLM-L6-v2 model. The resulting vectors are stored in a local FAISS index, so no document content ever leaves the user's machine. For conversational inference, a Conversational Retrieval Chain with multi-turn memory routes user queries to Google's Gemini 2.0 Flash model through Open Router, allowing the chatbot to maintain context across a dialogue rather than treating each question in isolation. A Streamlit-based web interface, with session-managed state, provides an intuitive front end for real-time interaction. To assess system quality, we evaluate performance using the RAG Triad framework, which confirms strong context relevance alongside low query latency. Overall, the system offers a practical, open-source alternative to commercial document-intelligence platforms, one that combines conversational flexibility with strict data privacy.

Keywords: Retrieval-Augmented Generation (RAG), Conversational Chatbot, Semantic search, PDF document processing, Data privacy, Local embedding

Artificial Intelligence Governance and the Rule of Law: Developing a Legal Framework for Future-Ready Societies

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Artificial Intelligence (AI) is drastically changing the way governments make decisions and how they deliver services. While AI may help governments make better decisions in a more efficient manner, there are valid legal concerns about the use of AI by public bodies. The use of AI may become a concern regarding transparency, accountability, privacy, discrimination, due process, and the rule of law. This article seeks to address the legal and governance issues arising from the use of AI in the public sector in the creation of intelligent decision-making systems. It addresses the legal challenges associated with intelligent and automated decision systems. It provides an analysis of the responsibilities of lawmakers, administrative bodies, and legal professionals in balancing the impact of technology with the democratic system and constitutional limits. This article employs the qualitative doctrinal methodology in analyzing the constitutional system and the legislative framework, as well as emerging international standards, while addressing and balancing the rights and interests of citizens and peaceable governance of AI. It makes a case for why governance using AI must be ultimately overseen by people and remain transparent and legally accountable. The author presents constructively a regulatory framework that will support technology and inventive governance systems while still protecting democracy and governance.

Keywords: Artificial intelligence, Rule of law, AI governance, Fundamental rights, Constitutionalism

Governing Cryptocurrency: Evaluating Institutional Design under Pakistan's New Regulatory Law

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Pakistan's Virtual Assets Act, 2026 recognized the first statutory regulator of country for cryptocurrency named as Pakistan Virtual Assets Regulatory Authority (PVARA) which will renovate a market of almost 30-40 million handlers, earlier operating without any legal context, into an officially licensed command within only eight months. PVARA is personified with comprehensive supremacies under this act like obligatory licensing, anti-money laundering prosecution, and harmonization responsibilities with the 'State Bank of Pakistan' and the 'Securities and Exchange Commission of Pakistan'. On the contrary, institutional design proposes that legal authority on its own never assurance regulatory success in comparative financial regulations. Political freedom, satisfactory technical possessions, and inter-regulator harmonization is mandatory for fully operational integrity. These characteristics naturally mature over time instead of legislation alone. This research targets to assess institutional construction of PVARA in contradiction of documented standards of regulatory political independence, board and technical structure, and inter-agency coordination, and to recommend reforms firming its institutional preparedness. By way of doctrinal legal analysis, this study observes the provisions of act which creates PVARA's structure and powers, executing regulations, and accessible findings from its initial functioning phase. It also analyses the September 2026 provisional licensing deadline under which prevailing virtual asset service providers were supposed to protect authorization or cease operations. The findings demonstrate though PVARA's legislative design is inclusive but applied political independence, inter-regulator coordination structure, and implementation capacity persist in primary phases of growth. The study concludes that country has attained legal fullness in regulating virtual assets more speedily than institutional maturity. Weakness of institution permits and endorses targeted modifications for solidification of PVARA's independence, technical and coordination structure to guarantee sturdy, future-proof financial governance of the digital asset.

Keywords: Cryptocurrency regulation, Institutional design, PVARA, Financial governance, Virtual and digital assets

Climate Changes Governance: Leadership and Policy Responses to Global Challenges

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The study offers a major contribution to the field of environmental politics by exploring into the underexplored domain of environmental governance. Though the Earth's ecosystem is almost unbelievably complex the logic of the climate change problem is relatively simple to describe. The earth's atmosphere acts as a greenhouse whereby various gases (Carbon dioxide, methane, chlorofluorocarbons, water vapor and others) handles solar radiation that would otherwise be rebound back to space before entering the Earth's atmosphere. However, after industrial Revolution Humanity has been emitting more greenhouse gases mostly through burning fossil fuels and coal, increasing their absorption in the atmosphere thus surging the warming effect. Climate changes governance requires governments to take a proactive role in bringing about shifts in interest perceptions so that enduring political consensus in favor of use an active moderation and adaptation policy regime can be maintained. Yet global society showed long ago that, through forward-thinking leadership, it could take visionary preventive actions to control climate change before its major and conceivably irreversible harmful impacts showed up and moved beyond human control. Now with Canada's leader present they noted the need for the reasonable use of energy resources in 1977 with the European community added they uphold the principle of more streamlined energy use at the first summit in 1978hosted by Germany at Bonn they explicitly stating in energy development the environment and human safety of their population must be safeguarded with utmost care(G7) 1978 and in Tokyo in 1979 they looked into the matter of carbon emissions directly and concluded that its concentration in the atmosphere must stabiles right away. On 28 June 1979 at the conclusion of their Tokyo Summit the leaders of the Group of Seven (G7) western democracies called for green energy so they would help to prevent further pollution caused by the increases of carbon dioxide and other harmful gases into the atmosphere.

Keywords: Global initiative, Climate changes, Governance, Policies, Greenhouse effect

Data Protection, Privacy and Digital Governance: Legal Challenges in Building Future-Ready Societies

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Digital transformation impacts the relationship between citizens, governments, businesses, and technology. More and more, public authorities use digital platforms and other technologies to collect and process data about individuals. Digital governance may bring administrative and service improvements, but there are privacy and surveillance concerns when personal data is collected and processed on a massive scale. This article examines the legal gaps concerning data protection and privacy in contemporary digital governance. Effective legal remedies are studied with a focus on future societies. Privacy as a legal right is assessed, and also legal principles of lawful data processing and consent, proportionality, transparency, purpose limitation, security of data, and accountability are reviewed. The article focuses on the legal obligation of government agencies and officials to protect citizens' personal information when digital technologies are used for governance. Analyzing defined constitutional rights and other domestic laws, the article studies principles and emerging standards of international data protection. The digital transformation of society may create opportunities for an unregulated rights environment where states implement extensive mass surveillance. This article advocates for a rights-based digital governance framework which incorporates privacy, transparency, accountability and is balanced by effective legal remedies.

Keywords: Data protection, Privacy, Digital governance, Surveillance, Fundamental rights

Policy, Leadership and Governance for Future-Ready Societies: A Socio-Legal Analysis of Pakistan's Constitutional and Legal Framework

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Rapid technological, economic and social transformation requires governments to develop effective policies, ethical leadership, and accountable institutions capable of responding to emerging challenges. This research study examines the role of policy, leadership, and governance in development future-ready societies, with particular reference to Pakistan's constitutional and legal system. Using a qualitative doctrinal approach, the study analysis constitutional provisions, legislation, judicial decisions, different scholarly literature concerning governance, institutional effectiveness, accountability, and digital transformation. Article 4, 9, 10A 19, 25 and 140A of the constitution of Islamic Republic of Pakistan, 1973 provide a foundation for future-oriented governance through the protection of fundamental rights, equality, democratic participation, rule of law, and decentralization (Constitution of Islamic Republic of Pakistan, 1973). In Benazir Bhutto v. Federation of Pakistan (PLD 1988 SC 416), the Supreme Court emphasized the importance of political participation and constitutional rights. While Mustafa Impex, Karachi v. Government of Pakistan (PLD 2016 SC 808) reinforced constitutional structured executive decision-making and institutional responsibility. Similarly, District Bar Association Rawalpindi v. Federation of Pakistan (PLD 2019 SC 318) underscores constitutionalism and institutional independence. The Digital Nation Pakistan Act, 2025 further provides a statutory framework for digital society, digital economy, and digital governance, demonstrating Pakistan's movement toward technology enabled public administration (Pakistan, 2025). Existing governance scholarship emphasizes institutional capacity, accountability, and effective governance as essential for sustainable development (Fukuyama, 2013; Kaufmann et al., 2010). The study argues that technology alone cannot produce future-ready societies; Pakistan requires ethical leadership, evidence-based policymaking transparency, public participation, institutional accountability, and rights-based digital governance to strengthen public trust, service delivery, resilience, and inclusive development.

Keywords: Future-ready governance, Public policy, Ethical leadership, Digital governance, Constitutionalism, Rule of law

Artificial Intelligence and the New Global Power Rivalry: The US–China Competition in Emerging Technologies

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Artificial Intelligence (AI) has emerged as a transformative technology reshaping global power relations, security strategies, and economic competition. This research examined how AI is influencing the strategic rivalry between the United States and China and how technological capabilities have become a new dimension of geopolitical power. The study explored the role of AI in military modernization, technological innovation, semiconductor competition, economic influence and global technology governance. The research adopted a qualitative comparative case study approach, analyzing secondary data from academic literature, policy documents, government reports and international research publications. Guided by the Realist perspective of International Relations, the study examined AI as a strategic resource through which major powers seek technological superiority, security advantages and global influence. The research argued that AI is becoming a critical element of twenty-first-century power competition, similar to earlier strategic technologies that shaped international politics. While the United States maintained advantages in advanced research, semiconductor technology, and private-sector innovation, China had rapidly expanded its AI capabilities through state-led initiatives and technological self-reliance strategies. This competition had significant implications for international security, economic relations and the development of global AI governance frameworks. The study concluded that AI is not merely a technological advancement but an emerging instrument of geopolitical power that is transforming the nature of great power rivalry. It highlighted the need for international cooperation and responsible governance mechanisms to manage the strategic challenges associated with AI development.

Keywords: Artificial Intelligence, US–China rivalry, Great power competition, Technological power, International security, AI governance.

Artificial Intelligence and Public Governance: Opportunities and Challenges for Future-Ready Societies

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Artificial Intelligence (AI) is fundamentally reshaping the architecture of public governance by transforming service delivery, policy formulation, information management, and administrative decision-making. While AI offers considerable potential to enhance institutional efficiency, transparency, and evidence-informed policymaking, its rapid proliferation simultaneously presents complex challenges relating to privacy, algorithmic discrimination, accountability, cybersecurity, and the protection of fundamental rights. This paper examines the transformative potential of AI in advancing future-ready governance, with particular emphasis on the opportunities and regulatory challenges confronting developing countries such as Pakistan. It explores the capacity of AI to strengthen public administration, healthcare, education, disaster management, and strategic policy planning while ensuring responsible, ethical, and rights-based deployment. The paper further considers emerging international approaches to AI governance and their implications for Pakistan's evolving regulatory landscape. It argues that technological innovation, in the absence of robust legal and institutional safeguards, may exacerbate existing inequalities, weaken accountability, and erode public confidence in governmental institutions. Future-ready governance therefore necessitates a balanced regulatory paradigm that simultaneously fosters technological innovation and establishes rigorous standards for transparency, accountability, human oversight, data protection, and ethical AI deployment. The paper advocates a comprehensive and adaptive AI governance framework capable of fostering inclusive, resilient, accountable, and technologically empowered societies.

Keywords: Artificial Intelligence (AI), Public Governance, AI Regulation, Digital transformation, Data protection

Exploitative Leadership and Employee Withdrawal: The Role of Workplace Ostracism and Organizational Politics

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This study examines the relationship between exploitative leadership and employee work withdrawal through workplace ostracism, while considering the moderating role of perceptions of organizational politics (POP). Based on Conservation of Resources (COR) theory, the study argues that exploitative leadership depletes employees' psychological resources, increasing feelings of workplace ostracism and subsequent withdrawal behaviors. Data were collected through a two-wave time-lagged survey from full-time employees in Pakistan's telecommunication sector and analyzed using structural equation modeling. The results show that workplace ostracism mediates the relationship between exploitative leadership and work withdrawal, while POP strengthens these relationships. The study contributes to COR theory by explaining how exploitative leadership and political organizational environments jointly contribute to employee withdrawal.

Keywords: Exploitative leadership, Workplace ostracism, Work withdrawal, Organizational politics, Conservation, Resources, Theory

Strengthening Rule of Law and Institutional Accountability for Future-Ready Governance: A Legal Framework for Sustainable and Inclusive Societies

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Building future-ready societies calls for governance systems characterized by transparency, accountability, and flexibility to respond to rapidly evolving social, technological, and economic changes. In this regard, the rule of law plays an important role in grounding institutional legitimacy, protecting the rights of individuals, and promoting responsible governance. This study explores the contribution of legal systems to institutional accountability and the formulation of good governance systems for achieving sustainable and inclusive societies. This study also seeks to problematize the consequences of the absence of enforceable laws, oversight, transparency, and accountability on the trust of the populace, as well as the quality of law protects, sustains, and promotes good governance. The study also considers the new challenges brought about by the digital age and the changing needs of society. This study adopts a doctrinal approach to qualitative research to analyze law, constitutional principles, courts' decisions, international law, and relevant literature. This study argues that future-ready governance goes beyond the creation of new policies. It also requires legal systems capable of implementing, monitoring, and enforcing policies. This study calls for flexible legal systems that are rights-based and that build trusting relationships with the people of inclusive and sustainable societies.

Keywords: Rule of law, Institutional accountability, Good governance, Legal reform, Sustainable development

Policy, Leadership, and Governance for Future-Ready Societies: A Legal and Administrative Perspective in the Context of Pakistan

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Pakistan is facing rapid social, technological and administrative changes that require public institutions to become more responsive, transparent and inclusive. This study examines how public policy, leadership and governance can support the development of a future ready society in Pakistan from a legal and administrative perspective. It focuses on the rule of law, accountability, institutional coordination, citizen participation, digital governance and protection of fundamental rights. The study follows a qualitative review method and is based on relevant academic literature, legal principles, policy documents and selected national and international governance frameworks. The review shows that the use of new technology alone cannot make public institutions future ready. Effective governance also depends on clear laws, responsible leadership, fair decision making, access to justice and public trust. It further shows that digital transformation should be introduced in a way that protects equality, privacy, human dignity and other basic rights. Strong coordination among government institutions, universities, civil society and the private sector can also help in responding to future social and technological challenges. The study argues that leadership has an important role in connecting policy decisions with the practical needs of citizens, especially young people, women and marginalized groups. It concludes that Pakistan needs a balanced approach in which innovation and technology are supported by rule of law, accountability and human rights. Future readiness should therefore be understood not only as technological progress but also as the ability of institutions to make fair, informed and timely decisions. Such an approach can contribute to more resilient, inclusive and citizen centered governance in Pakistan.

Keywords: Future-ready societies, Rule of law, Adaptive leadership, Digital governance, Human rights

Pakistan's External Debt and Economic Sustainability: The Roles of China, the IMF and Domestic Fiscal Constraints

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Pakistan faced persistent fiscal and external financing pressures, reflected in a continuing gap between government revenues and expenditures and substantial reliance on external financing. This study examined Pakistan's external debt position, focusing on financing from China and the International Monetary Fund (IMF) while assessing how domestic fiscal constraints contributed to continued borrowing and debt-servicing pressures. The study employed a quantitative descriptive research design based on secondary data analysis. Data were collected from official national and international sources, including the IMF, State Bank of Pakistan (SBP), Ministry of Finance Pakistan, Economic Survey of Pakistan and World Bank. The analysis covered external public debt, Chinese bilateral and commercial financing, IMF obligations, government revenues and expenditures, fiscal deficits, and debt-service obligations for recent fiscal years. Percentage analysis, trend analysis and comparative analysis were applied, using Microsoft Excel and SPSS for data organization and analysis. The findings indicated that Pakistan's fiscal position remained constrained by a persistent revenue–expenditure gap. In FY2024/25, government revenue and grants were 15.8% of GDP, compared with expenditure of 21.2%, resulting in an overall budget deficit of 5.4% of GDP. As of June 2025, China accounted for approximately US$23.5 billion of Pakistan's bilateral external debt, while IMF obligations were approximately US$9.3 billion. The findings highlighted that external financing sustainability depended not only on borrowing levels but also on productive use, economic returns, foreign-exchange-generating capacity and future debt-servicing requirements. The study concluded that stronger domestic revenue mobilization, improved expenditure management, productive investment, export diversification and transparent debt governance were essential for strengthening long-term economic sustainability and reducing repeated dependence on external financing.

Keywords: Pakistan, China, IMF, External debt, Fiscal sustainability

Regulating Artificial Intelligence for Sustainable Governance: A Legal Framework for Future-Ready Societies

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Artificial Intelligence (AI) is transforming public administration, policymaking, economic development and social services. Despite the vast potential benefits of AI in modern governance, its development and application raise crucial questions about legality, ethics and administration. This paper aims to address the importance of developing a legal and regulatory framework for AI in future societies. The study will focus on AI's implications, including transparency, accountability, privacy and discrimination. In addition, the research will highlight the role of legislators, policymakers, public officials and judges in regulating AI decision-making processes. The findings will support the need for a regulatory framework for AI to promote transparency, legality and accountability in decision-making. The research will be conducted to identify the importance of a regulatory framework for AI governance. The key themes explored include transparency, accountability, privacy and discrimination. The study will also examine the role of legislators, policymakers, public officials and judges in AI regulation and emphasize the significance of legality and ethics in future societies. The paper will argue that laws and regulations are necessary for ensuring that AI technology supports communities while minimizing risks and security concerns. A regulatory framework for AI governance will be a crucial mechanism for promoting sustainable development in future societies. The authors will utilize a normative legal research design based on extant literature, journals, and articles to generate conclusions about the study's problem. The research will focus on the implications of AI governance, including transparency, accountability, privacy, and discrimination. In addition, the article will review the role of legislators, policymakers, public officials and judges in regulating AI decision-making processes. The findings will support the claim that a regulatory framework for AI governance is critical in promoting accountability, transparency, and legality in future societies.

Keywords: Artificial Intelligence (AI), Sustainable governance, Legal regulation, Future-ready societies, Algorithmic accountability, Data protection, Fundamental rights

Cyber Security Law and Digital Governance: Protecting Citizens and State Institutions in the Digital Age

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Digital technologies have changed the way citizens, governments and public institutions communicate and interact with businesses. Digital governance has improved the efficiency of public services but has also introduced risks of cybercrime and disruptions to critical services. This research analyzes the benefits and challenges of cybersecurity laws to develop digital governance systems designed for flexible and adaptive societies. This research analyzes the legal obligations of governments and technology providers to address cyber threats and defend digital infrastructure. This research analyzes the legal defenses provided for cyber offenses, electronic evidence, and data breaches. Special consideration is provided for the balance between national cybersecurity needs and the right to privacy, the right to freedom of expression, and the right to access digital services. The research uses a qualitative doctrinal analysis to evaluate and interpret legislative frameworks, case law, and international law. This research is designed to analyze the benefits and challenges of creating a flexible yet functional system of digital governance and cybersecurity to protect the right to privacy and other human rights.

Keywords: Cybersecurity, Digital governance, Cybercrime, Data security, Digital rights

An Institutional Analysis of Teachers' Code of Professional Conduct and Ethics

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The strength of the teaching profession rests not only in the competencies but also the ethical standards teachers uphold. The first objective of the study was to identify the perception and awareness level of teachers regarding the professional code of conduct and second objective of the study was to investigate the perception and awareness level of faculty in the context of moral and ethical qualities in an academic institution. Another objective was to identify the problems teachers face regarding knowledge and awareness of these professional codes of conduct and ethics at Government university. The research approach was quantitative, and the design was descriptive. The faculty members of the university were the participants of the study and purposive sampling technique was used. The data was collected through questionnaire with closed-ended items. Data was analyzed through mean, percentages, and frequencies. The significant finding of the study indicated that faculty members at university had awareness level towards code of professional conduct and ethical qualities but faculty members were facing problems in understanding codes and were not involved in the process while making these policies. The study concluded that there is need to explicitly present the codes in documented form to avoid any sort of uncertainties. It is recommended that teachers may be involved while making these policies and proper training sessions should be conducted in order to get insight of the issues that remain untouched due to certain ambiguities.

Key words: Code of conduct, Code of ethics, Professionalism, Teachers' Perception

Legal Aid and Access to Justice: Challenges and Opportunities

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Access to justice is a core prerequisite for rule of law and absolute protection of individuals. Although Pakistan has a constitutional and legal framework for protection of rights, many underprivileged and financially stressed individuals experience concrete hurdles seeking legal stress and justice. Previous studies have explored legal aid, language barriers, legal assistance and technology as key pillars of access to justice. The study adopts a doctrinal, qualitative legal research method on the basis of existing literature review, constitutional provisions, judicial decisions and scholarly articles. Worldwide achievements in artificial intelligence (AI)and legal technology (legal tech) have taken initiative to transform delivery of justice via data analysis, online dispute resolution (ODR) and automated document system, Pakistan has a free-legal aid system which works on constitutional guarantees and is supported by institutions like Legal Aid And Justice Authority (LAJA) which was founded by the Legal Aid and Justice Authority Act,2020.This system provides legal aid to poor and needy masses who cannot afford legal representation. The findings suggest that monetary constraints, lack of awareness, insufficient legal assistance to marginalized individuals and geographical barriers can restrict access to justice in an effective way. Technology may reduce geographical barriers, however digital divide, privacy concerns and lack of institutional coordination, remain challenges. The study concludes that legal aid and technology as an amazing combination can help people in getting justice. This combined approach can make justice accessible for poor and marginalized communities. Finally, robust state backing and coordination among institutions of law and justice are required to create a more comprehensive and accessible legal aid system.

Keywords: Legal aid, Rule of law, Legal technology, Artificial Intelligence, Digital divide, Online Dispute Resolution (ODR), Legal Aid and Justice Authority (LAJA)

Shaping a Future-Ready Pakistan: Policy, Leadership and Governance Pathways for Inclusive and Sustainable Development

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Pakistan's journey towards sustainable and inclusive development is a complex and multifaceted process that involves numerous factors. Although the country has made significant progress in terms of hundreds of federal reforms and digitalization initiatives, there are still major challenges that hinder the country's sustainable development. This paper examines the governance reforms necessary to prepare Pakistan for the challenges and opportunities of the future, particularly in relation to skills development for the changing demands of the labour market. The paper employs a qualitative method by conducting a review of the recent literature, reports, and documents. Pakistan has taken several policy and programmatic steps such as e-governance reforms, the "National AI Policy," and climate governance to cope with climate change and digital transformation. However, despite the policy and programmatic initiatives to cope with challenges of the future, significant challenges remain in Pakistan's efforts to transform into a future-ready country, including institutional fragmentation, implementation gaps, regulatory vacuums, digital divides, skill mismatches, weak inter-sectoral coordination, and policy discontinuity. The paper's primary contribution is to build upon the synthesized information by proposing institutional and governance strengthening, digital and AI-enabled governance, ethical leadership, future-oriented skills development, and climate and environmental sustainability. It argues that without strengthening leadership capacity and institutions that inspire the confidence and trust of the people, future readiness cannot be ensured by individual sectoral reforms and technological advancements. The paper offers an integrated and multi-dimensional policy framework that links quality of governance, ethical and effective leadership with sustainable development for a future-ready Pakistan.

Keywords: Future-ready Pakistan, Governance reform, Leadership, Digital transformation, sustainable development

From E-Governance to the Digital State: Rethinking Legal Accountability, Ethical AI, and Public Institutional Governance in Pakistan

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The public sector in Pakistan is slowly transitioning from the fragmented e-governance ecosystem to a digital state, driven by the statutory transition from e-governance to E-State Pakistan under the Digital Nation Pakistan Act 2025 and the National Data Governance Policy 2026. These programs seek to modernize public service delivery, develop digital public infrastructure (DPI), and implement public-sector Artificial Intelligence (AI); however, they create significant legal, ethical, and institutional vulnerabilities. This paper critically examines the institutional transition to digital statehood in Pakistan and its tensions with constitutional provisions for safeguarding the right to privacy. The research will explore state automated decision-making, digital identity platforms (NADRA), data exchange layers and state AI integration through a socio-legal, policy-evaluative and comparative administrative lens. It also identifies certain governance weaknesses, such as legal accountability issues arising from statutory indemnity provisions, extensive executive immunity, and the absence of any personal data protection statute in force; ethical risks of AI, which include algorithmic opacity, automated profiling, and citizens' lack of consent; and institutional oversight challenges, where bodies such as the Pakistan Digital Authority (PDA) are characterized by their lack of independent judicial review mechanisms, with decision-making concentrated in the executive arm. In the quest for state-led digital efficiency while respecting fundamental rights, this research proposes a dynamic governance reform model. It calls for Article 14 (Right to Privacy) and Article 10-A (Fair Trial) of the 1973 Constitution to be codified and incorporated into the law, and for strict accountability under the law for those making automated and other decisions, as well as an independent, multi-stakeholder Algorithmic & Digital Rights Ombudsman to ensure that public governance is conducted in an ethical, transparent, and constitutionally anchored manner.

Keywords: Digital state, e-governance, Legal accountability, Ethical AI, Public institutional governance

Building a Future-Ready Pakistan: Policy, Leadership and Governance for Institutional Transformation

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Pakistan has, during the past eight decades, carried out a myriad of political, administrative, and institutional reforms, but most initiatives were neither sustainable nor able to achieve the desired objectives. The state's lackluster performance is due to weaknesses in institutional capacity, policy implementation, accountability, public service delivery, and public trust. It brings to the fore questions about the capacity of existing governance arrangements to respond effectively to emerging challenges. This study examines the relationship between policy, leadership and governance in shaping Pakistan's institutional performance and explores how these dimensions can be reconfigured to create a future-ready society. Using a qualitative research design, the study employs document analysis of major policy, administrative and institutional reform initiatives undertaken since independence, supplemented by semi-structured interviews with policymakers, public officials, governance experts and other key stakeholders. To examine institutional modernization, Systems Thinking has been employed as an overarching analytical lens. The study uses thematic analysis to identify recurring patterns relating to policy continuity, leadership, institutional capacity, accountability, reform implementation and institutionalization. Particular attention is given to major reform episodes under successive political regimes to identify why some reforms failed to become durable institutional arrangements. The study argues that Pakistan's governance challenge is not simply a deficit of policies or reform initiatives, but a persistent gap between policy intent, leadership, institutional capacity and implementation. It proposes a future-ready governance framework centred on capable and ethical leadership at multiple levels, evidence-based and adaptive policymaking, institutional accountability, policy continuity, technological innovation and citizen-centred governance. The study concludes by offering pragmatic policy measures aimed at strengthening institutional resilience, rebuilding public trust and improving the state's capacity to anticipate and respond to future challenges.

Keywords: Governance reform, Institutional capacity, Policy implementation, Political leadership

Can Directors Delegate Judgment to an Algorithm? AI-Assisted Decision-Making and Directors' Liability under Pakistani Corporate Law

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Directors are starting to rely on artificial intelligence in significant corporate decisions. If one of those decisions later causes harm, how far can they still be held responsible? The Companies Act 2017 does not address AI-assisted board decisions, but it requires directors to act with due and reasonable care, skill and diligence and to exercise independent judgment. It is unclear whether those duties suffice when technology substantially influences the decision. This paper examines how Pakistani corporate law applies to AI-assisted board decisions, focusing on the line between using AI as a tool that supports human judgment and relying on it so heavily that the decision is in effect delegated. It asks whether directors can escape responsibility by attributing the outcome to the AI system, and how independent judgment, reasonable reliance, and human oversight apply in such situations. It also considers how responsibility may be allocated when an AI-assisted decision harms the company or others. The paper uses doctrinal analysis of the Companies Act 2017 and related Pakistani corporate laws, supported by relevant case law, precedents, and emerging approaches to AI governance. The paper argues that using AI does not, in itself, relieve directors of their legal duties. They must still exercise independent judgment and reasonable care, even when technology assists them. Heavy or uncritical reliance on AI, however, raises accountability questions that current law does not clearly answer. The paper therefore proposes clearer standards on reasonable reliance, human oversight, and independent judgment, while keeping human accountability for board-level decisions as the basic principle.

Keywords: Artificial intelligence, Companies Act 2017, Corporate governance, Independent judgment



SMART HEALTH CARE SYSTEMS DISCOVERY TO PRACTICE

ORAL

PRESENTATIONS

From Biomarker to Bedside: Translating AI-Driven Digital Health Innovation into Clinical Practice

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Artificial intelligence (AI) and digital health technologies are generating a new generation of biomarkers, drawn from wearable sensors, smartphone interactions, medical imaging, electronic health records, and multi-omics data. These tools promise earlier detection, more precise risk stratification, and continuous monitoring beyond the clinic. Yet despite thousands of published models, only a small fraction reaches routine care. This review examines the pathway from biomarker discovery to bedside implementation and identifies the barriers that stall translation. We synthesize current evidence across the translational pipeline: data acquisition and curation, algorithm development, analytical and clinical validation, regulatory approval, and clinical integration. Particular attention is given to digital biomarkers in cardiology, neurology, oncology, and mental health, where early deployments illustrate both progress and pitfalls. Workflow misfit, clinician distrust, alert fatigue, and unclear reimbursement further limit adoption. We also discuss evolving regulatory frameworks, including adaptive oversight of software as a medical device and requirements for post-market surveillance. Evidence suggests that successful translation depends on more than predictive accuracy. Effective solutions demonstrate clinical utility through improved patient outcomes, are developed with clinicians and patients as co-designers, and are embedded seamlessly into existing workflows. Explainability, fairness auditing, and continuous performance monitoring are essential for sustaining trust and safety. Implementation of science methods, including pragmatic trials and real-world evidence generation, offer a rigorous route to demonstrating value. We propose a practical framework linking technical validation, regulatory readiness, ethical governance, and health system integration. Aligning these elements can shorten the gap between innovation and impact. Ultimately, realizing the promise of AI-enabled digital biomarkers requires multidisciplinary collaboration, equitable design, and a steadfast focus on measurable patient benefit, ensuring that these technologies enhance, rather than complicate, clinical care.

Keywords: Artificial intelligence, Digital biomarkers, Digital health, Clinical translation, Implementation science

Natural Product-Based Smart Healthcare: Therapeutic Potential of *Cassia absus* Seeds Extract Against Diet-Induced Dyslipidemia

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Dyslipidemia is a major risk factor for atherosclerotic disorders, myocardial infarction, cerebral stroke, and heart disease. Various medicinal plants are being used for the treatment of dyslipidemia; however, *Cassia absus* seed extract was not investigated for its anti-dyslipidemia effect. The current study was designed for phytochemical analysis and the anti-dyslipidemic effect of *Cassia absus* in HFD-induced dyslipidemia in rats. For this purpose, 40 Albino Wistar rats were allocated into five groups. The G1 was the normal control (NC) given routine diet, G2 was disease control (DC) without treatment, G3 was standard group (statin 2.5mg/kg), G4 and G5 were given low and high dose of *Cassia absus* seed aqueous extract (250 mg/kg and 500 mg/kg) respectively. Proximate analysis and qualitative as well as quantitative phytochemical analysis were performed. For the estimation of the anti-dyslipidemic potential, lipid profile, antioxidant, and health markers were evaluated. Histopathological alterations in liver tissue were observed. The phytochemical analysis showed that *Cassia absus* seed extract possesses flavonoids and phenols. The serum biochemical test showed significant anti-dyslipidemic potential of *Cassia absus* seed extract. Data were statistically analyzed by ANOVA.

Keywords: Flavonoids, Phenols, Phytochemical, Dyslipidemia, Antioxidants

Nutrients beyond Food: Sustainable Therapeutic Tools for Future-Ready Healthcare

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Beyond the traditional view, nutrients have emerged as important modulators of metabolic, inflammatory, oxidative, immune, and microbial pathways. This evolving concept positions nutrition not merely as a source of nourishment, but as a sustainable component of preventive and therapeutic healthcare. In this talk, we will present the potential of nutrients and food-derived bioactives as sustainable therapeutic tools and discusses how it can contribute to future-ready healthcare systems. Nutrients and bioactive components can influence biological pathways associated with metabolic disorders, cardiovascular disease, inflammation, oxidative stress, and gut health. We observed that nutrient supplementation effectively addresses diabetes, uterine fibroids, and hormonal regulation and many more. We will present a few cases regarding the role in addressing metabolic issues. At the same time, personalized and precision nutrition, supported by artificial intelligence, multi-omics, and digital health technologies, offers opportunities to design interventions according to individual metabolic and nutritional profiles. Nevertheless, translation into clinical practice requires rigorous evidence regarding efficacy, safety, dose, bioavailability, and long-term outcomes. Thus, modern technologies provide an opportunity to move from a conventional "food versus medicine" paradigm toward an integrated food–nutrition–healthcare continuum. Harnessing nutrients as evidence-based therapeutic tools could contribute to affordable, preventive, personalized, and environmentally sustainable healthcare for future-ready societies.

Keywords: Nutrients, Therapeutic nutrition, Nutraceuticals, Healthcare

Smart Health Care Systems: Discovery to Practice

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The rapid convergence of artificial intelligence, the Internet of Things (IoT), big data analytics, and cloud computing has catalyzed a paradigm shift in healthcare delivery, giving rise to what is now termed "smart healthcare." This transition moves the sector from traditional, reactive, hospital-centered care toward a proactive, personalized, and continuously connected ecosystem. This abstract examines the journey of smart healthcare systems from foundational research and technological discovery to real-world clinical practice and adoption. However, translating these innovations from controlled research environments into everyday clinical practice presents substantial challenges, including data privacy and security concerns, interoperability across health information systems, regulatory compliance, algorithmic bias, and the need for clinician trust and digital literacy. This paper explores key enabling technologies—including 5G connectivity, edge computing, blockchain for secure data sharing, and explainable AI—that facilitate the practical deployment of smart healthcare solutions. Case studies of telemedicine platforms, AI-assisted diagnostic tools, and smart hospital infrastructures illustrate both the successes and persistent barriers encountered during implementation. The discussion emphasizes the importance of multidisciplinary collaboration among technologists, healthcare providers, policymakers, and patients to ensure that smart healthcare innovations are not only technically sound but also ethically responsible, equitable, and scalable. Ultimately, this work argues that bridging the gap between discovery and practice requires a holistic framework encompassing robust validation, supportive policy environments, and human-centered design. By addressing these challenges, smart healthcare systems can fulfill their promise of improving patient outcomes, reducing costs, and enhancing access to quality care worldwide.

Keywords: Internet of Things. AI, Quality care

Artificial Intelligence in the Design of Nanovaccines, RNA Therapeutics: Current Molecular Approaches

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This work aimed to analyse the latest research on RNA therapeutics, nanovaccines, and immunomodulation, and highlights translational potential, implementation issues, and directions for the future in the context of a multidisciplinary. Recent advances in molecular biology, nanotechnology, and immunology have been accountable for the advent of next-generation preventive and therapeutic methodologies. Prevention of infectious diseases is undergoing a revolution with updated and current molecular approaches, enabling faster, safer, and more effective alternatives to conventional vaccines and antivirals. Nanovaccine platforms apply liposomes, polymeric nanoparticles, and virus-like particles to improve antigen stability, targeted delivery, and dose efficiency with oral and intranasal formulations for mass immunization and field deployment. Integration with computational biology, omics, and systems immunology enables rational design, predictive modelling, and expediting preclinical development. The most recent developments in nanotechnology and molecular biology have transformed infectious disease prevention at its foundations. Nanovaccines, RNA therapeutics, and immunomodulation approaches offer targeted, scalable, and highly effective tools that improve immunogenicity, reduce doses of antigen, and allow rapid adaptation against emerging pathogens. The integration of AI with molecular approaches also offers paths for precision and personalized vaccinology. Finally, in line with the purpose of this study, vaccines and treatments have been comprehensively evaluated in this context and scope, taking into account current approaches in the age of artificial intelligence.

Keywords: Artificial Intelligence, Immunomodulation, Nanovaccines, RNA therapeutics

Label Watch Pakistan: A Crowd-Based Nutrition Label Transparency and Front-of-Pack Warning Assessment Tool

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There is currently no nationally implemented system for front-of-pack warnings on packaged foods in Pakistan, while nutrition panels at the point of purchase can be difficult for consumers to interpret. Label Watch Pakistan enables consumers to scan or search for a product, assess it against the PAHO Nutrient Profile Model and NOVA processing classification, generate comprehensive health ratings, and compare products with lower-risk alternatives. The platform was developed to improve access to interpretable nutrition information and support informed food choices. Pakistan currently has no equivalent legislation for mandatory front-of-pack nutrient warning labels, although such systems are used in several Latin American countries, including approaches informed by the PAHO Nutrient Profile Model. Consumers often depend on nutrition labels that can be difficult to interpret, while consumption. When a product receives a poorer assessment, the platform identifies lower-scoring alternatives registered within the same category. The scan-score-compare workflow has been developed and is functional, with core features including product scanning, health scoring, NOVA classification, and alternative comparison. The platform is currently in the pre-launch stage and is planned for a six-month rollout across 10 partner universities through a youth Nutrition Ambassador model. The rollout targets include documenting more than 2,000 products and reaching more than 100,000 people; these are implementation targets for the next phase and are not achieved results. The development of Label Watch Pakistan demonstrates the feasibility of translating PAHO and NOVA criteria into a consumer-facing digital tool for packaged-food assessment. By combining nutrition-risk assessment, processing classification, and product comparison, the platform can improve access to interpretable nutrition information and support healthier food choices. Its expanding crowdsourced database also has potential to provide locally relevant evidence on the nutritional characteristics of packaged foods in Pakistan.

Keywords: Nutrition labelling; Front-of-Pack warning labels; NOVA Classification; Digital health; Food choice

Protective and Synergistic Effects of Catechin and Vitamin B2 Against Diet-Induced Atherosclerosis through Regulation of Oxidative, Inflammatory, and Metabolic Pathways

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Atherosclerosis is a major vascular disease characterized by excessive lipid accumulation in blood vessels, oxidative stress, and inflammation at the cellular level. Natural compounds such as Catechin and Vitamin B2 may provide protective effects against vascular dysfunction. To evaluate the protective effects of Catechin and Vitamin B2, individually and in combination, against high-fat diet–induced vascular dysfunction in rats. Thirty rats were divided into five groups (n = 6): normal control, positive control (24% high fat diet + 20% sugar), standard drug (atorvastatin; 1.5 mg/kg oral), phytochemical (catechin; 7.5mg/kg oral), and Complex (catechin + Vitamin B2; 3 mg/kg oral). Hematological indices, oxidative stress, hepatic and renal function, lipid profile, and vascular changes were assessed. The high-fat diet showed increased inflammatory and metabolic disturbances, oxidative imbalance, plaque formation, and alterations in hematological and biochemical parameters. Monotherapy with catechin and Complex therapy improved these changes, with the combined treatment showing greater overall protective effects than individual treatments. Catechin and vitamin B2 demonstrated promising protective effects against experimental vascular dysfunction, potentially through antioxidant, anti-inflammatory, metabolic, and lipid-modulatory mechanisms. The combined administration showed enhanced overall efficacy. Future nutraceutical therapeutics should focus on molecular pathways that mimic natural antioxidant activity and restore vascular integrity during disease progression.

Keywords: Atherosclerosis, Vascular dysfunction, Endothelial integrity, Oxidative stress, Metabolic dysfunction, Herbal flavonoids.

Beyond The Bone: Annatto-Co Q10 Shielding Against Zoledronic Acid-Induced Hepatorenal Injury

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Zoledronic acid (ZA) is a potent bisphosphonate widely used for the management of skeletal disorders, but its systemic toxicity may involve hepatic and renal dysfunction. The present study investigated the protective effects of Annatto seed extract (Bixa orellana) and Coenzyme Q10 (CoQ10), individually and in combination, against ZA-induced hepatic and renal toxicity in Wistar rats. Thirty adult male Wistar rats were randomly allocated into six groups (n=5): control, ZA, ZA+Annatto, ZA+CoQ10, ZA+Annatto+CoQ10, and ZA+N-acetylcysteine (NAC). Following induction of ZA toxicity, treatments were administered for four weeks. Hepatic function was evaluated through serum alanine aminotransferase, aspartate aminotransferase, alkaline phosphatase, albumin, total protein, total bilirubin and direct bilirubin, while renal function was assessed using serum creatinine and blood urea nitrogen. ZA administration produced marked biochemical alterations, with progressive increases in hepatic enzymes, bilirubin, creatinine and BUN, accompanied by a decline in total protein. By Week 4, total protein decreased from 7.30±0.08 g/dL in controls to 4.92±0.08 g/dL in the ZA group, whereas the ZA+Annatto+CoQ10 group maintained 6.72±0.08 g/dL. Total bilirubin increased to 1.62±0.05 mg/dL in the ZA group compared with 0.78±0.04 mg/dL following combined treatment. BUN similarly increased to 54.4±1.1 mg/dL after ZA exposure, compared with 27.6±1.1 mg/dL in the combination group. Overall, Annatto and CoQ10 attenuated ZA-associated hepatic and renal biochemical alterations, with combined treatment demonstrating pronounced protective effects. These findings highlight the potential of the Annatto CoQ10 combination as a protective strategy against ZA-induced systemic toxicity.

Keywords: Zoledronic acid, Annatto, Coenzyme Q10, Hepatotoxicity, Nephrotoxicity

Prescribing Food, Not Just Medicine: A Primary Healthcare Model for Nutrition Equity in Pakistan

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Malnutrition and diet related non-communicable diseases builds extreme hardship in Pakistan that significantly affects the socioeconomically marginalized populations and vulnerable groups. Standard medical and clinical care often cures and provides treatment for different metabolic symptoms by means of pharmaceuticals, leaving food security unresolved and neglected. The study assesses the viability and medical health consequences of a program, "Food Is Medicine," using specific generated instructions as a component of routine outpatient care. A potential intervention study was carried out at three primary healthcare centers for six months, including low-income patients with diet-sensitive persistent conditions (n=150). Participants were given monthly generated vouchers combined with dietary counseling and regular clinical care. Using the Household Food Insecurity Access Scale (HFIAS), household food security was evaluated. Biomarkers along with HbA1c, lipid profiles, and blood pressure were considered at baseline and post-intervention. Paired t-tests ($p<0.05$) were used for analyzing data. Participants (n=138) completed the program and exhibited a significant reduction in mean Hb1Ac (0.6%-0.8%). Moderate to severe household food insecurity was reduced by up to 40%, with a 42% increase in dietary scores. Systolic blood pressure reduced by an average. Implanted food prescriptions in primary healthcare result in a sustainable, equity-focused approach to regulate non-communicable diseases and enhance glycemic control, cardiovascular health, and household food security. Evolving around conventional pharmaceuticals, nutrition-centered care offers a policy-relevant strategy for public health campaigns in limited-resource environments.

Keywords: Nutrition Equity, Prescriptions, Primary Healthcare

Impact of Goal-Oriented Play Activities on Selected Variables of Gross Motor Development in Children

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Gross motor skills use large muscle groups for activities such as running, jumping and throwing, and play a potential role in the overall growth and physical development of children. Gross motor skills are essential for promoting coordination, strength, speed, and physical fitness. Goal-oriented play activities, which provide structured and purposeful physical engagement, have the potential to improve gross motor abilities and minimize these negative habits. The study aimed to investigate the impact of Goal-oriented play activities on selected variables of Gross motor development (jumping, running and throwing) in school-going children. A quantitative experimental research design was used. The population of the study was 40 school-going children aged 8–12 years. The training sessions were conducted thrice weekly over a period of 12 weeks. Data collection consisted of running 25m, throwing the ball as far as possible and locomotor jumping. The participant's selection was recruited randomly based on the inclusion criteria until the completion of forty (40) participants. The experimental group participated in goal-oriented play activities. The control group continued with their routine without any structured intervention. Data collection involved performance measurements in each activity, such as speed, distance, and jumping ability. Shapiro-Wilk tests were used to check data normality, and paired sample t-tests were conducted to determine statistical significance at $p < 0.05$. Results showed a significant improvement in the experimental group across all measured variables. The finding shows that goal-oriented play activities potentially enhanced children's speed, strength, and coordination as compared to the control group, which showed no change. In general, the study shows that students gain strength, coordination, speed, confidence, and healthy habits from these kinds of activities. These findings could be used by teachers to design structured physical education classes that monitor student progress and encourage skill improvement.

***Keywords**:* Goal-oriented-play activities, Gross motor skill, child development, Motor development, intervention

Diagnostic Accuracy of Multiparametric MRI for Prostate Cancer Detection: A Meta-Analysis

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Early detection of clinically significant prostate cancer (csPCa) is essential for timely treatment while avoiding unnecessary biopsies and overtreatment. This systematic review and meta-analysis aimed to determine the diagnostic accuracy of multiparametric magnetic resonance imaging (mpMRI), including evidence from biparametric MRI (bpMRI), for detecting csPCa. PubMed, Embase, Web of Science, Scopus, and the Cochrane Library were searched from inception to March 2026. Eligible prospective, retrospective, and randomized studies evaluated mpMRI or bpMRI in adult men and used histopathology as the reference standard. Two reviewers independently extracted study and diagnostic accuracy data, and risk of bias was assessed using the Quality Assessment of Diagnostic Accuracy Studies 2 (QUADAS-2) tool. Diagnostic estimates were pooled using a bivariate random-effects model. Twenty-three studies involving more than 8,000 participants were included. The pooled sensitivity of mpMRI for csPCa was 93.3% (95% confidence interval [CI], 87.6–96.4%), while pooled specificity was 57.5% (95% CI, 45.1–69.0%). The diagnostic odds ratio was 18.75, the positive likelihood ratio was 2.20 (95% CI, 1.64–2.94), and the negative likelihood ratio was 0.12 (95% CI, 0.06–0.20). Between-study heterogeneity was substantial (I^2 = 95.1%), indicating variability in diagnostic performance across studies. These findings suggest that mpMRI has high sensitivity and may be particularly useful for identifying men unlikely to have csPCa and informing biopsy decisions. However, its moderate specificity means positive findings require careful interpretation and, where clinically indicated, histopathological confirmation. More standardized imaging protocols and reporting, together with consideration of reader expertise and patient characteristics, may improve consistency and clinical utility.

Keywords: Prostate cancer, Multiparametric MRI, Diagnostic accuracy, Meta-analysis, Clinical significance

Self-Efficacy as a Predictor of Diabetes Management Behavior: A Social Cognitive Theory Approach

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Diabetes self-management involves daily adherence to healthy dietary practices, physical activity, blood glucose monitoring, medication use, and foot care. To determine whether self-efficacy predicts diabetes self-management behaviour among adults with diabetes using a social cognitive theory approach. A cross-sectional study was conducted among 425 adults with diabetes attending a tertiary-care hospital. Data was collected using modified Urdu versions of the Diabetes Management Self-Efficacy Scale (U-DMSES) and the Summary of Diabetes Self-Care Activities measure (U-SDSCA). Descriptive statistics were used to summarize participant characteristics and study variables. Participants reported high overall self-efficacy, with a mean score of 86.14, and practiced diabetes self-management activities for a mean of 4.14 days per week. Self-efficacy showed a significant positive correlation with overall diabetes self-management ($r=0.389r = 0.389r=0.389$, $p<0.001p < 0.001p<0.001$). Higher self-efficacy was significantly associated with healthier dietary practices, physical activity, and blood glucose monitoring. However, no significant association was observed with medication adherence or foot care. In the adjusted regression model, self-efficacy remained a significant independent predictor of overall diabetes self-management ($\beta=0.409\beta = 0.409\beta=0.409$, $p<0.001p < 0.001p<0.001$), and the model explained 42.1% of the variance in self-management behaviour. Self-efficacy is an important predictor of diabetes self-management among adults attending a tertiary-care hospital. Strengthening patients' confidence in managing diabetes may improve adherence to diet, exercise, and blood glucose monitoring. Because of the cross-sectional design, single-center convenience sampling, modified assessment tools, duplicate records, and incomplete clinical data, causal conclusions and broad generalization should be made cautiously. Future longitudinal and intervention-based studies using validated tools and objective glycemic indicators are recommended.

Keywords: Diabetes Mellitus, Self-efficacy, Self-management, Social cognitive theory



SMART HEALTH CARE SYSTEMS DISCOVERY TO PRACTICE

POSTER

PRESENTATIONS

Comparison of Satisfaction and Vision-Related Quality of Life Between Optical and Electronic Aid Users: A Cross-Sectional Study

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Visual impairment significantly affects an individual's ability to perform daily tasks, affecting their independence and vision-related quality of life. This study aimed to compare the level of satisfaction and vision-related quality of life among participants with low vision using optical and electronic aids. A cross-sectional study was conducted with 84 participants aged 4-65 years (42 using optical aids and 42 using electronic aids). Data were collected using a standard questionnaire. The Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0) consists of 12 items and was used to assess the satisfaction of participants. The System Usability Scale (SUS) consists of 10 items and was used to assess the usability of low-vision aids. Low Vision Quality of Life (LVQOL) consists of 25 items and was used to assess the effect of low vision on individuals' vision-related quality of life. Statistical Package for Social Science (SPSS) version 26 was used for data tabulation and analysis. Significant differences were found across all QUEST 2.0 domains ($p<0.001$, $r=0.395$-0.784). The SUS score also favored electronic aids, particularly for confidence in device use ($p<0.001$, $r=0.633$). The LVQOL score showed significantly better outcomes among electronic aid users, with the greatest improvement in general vision ($p=0.001$, $r=0.529$). The use of electronic aids was associated with higher scores in the selected domains. The results of this study demonstrate the possible benefits of electronic aids in supporting the functional vision and quality of life of individuals with low vision.

Keywords: Low vision, Assistive devices, Optical aids, Electronic aids, User satisfaction;

Accuracy of Color Doppler Imaging for Diagnosis of Peripheral Artery Disease Taking Ankle-Brachial Index as the Gold Standard

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Peripheral Artery Disease is a prevalent vascular abnormality which is often underdiagnosed, especially in high-risk patients such diabetes, hypertension, and coronary artery disease. Although the ABI is still the most popular non-invasive test for PAD screening, its accuracy is compromised in individuals with calcified or poorly compressible arteries, such as those who are elderly or have diabetes. To find the accuracy of color Doppler imaging for diagnosis of peripheral artery disease, taking the ankle-brachial index as the gold standard. Over the course of nine months, adult patients (≥18 years) who were referred for evaluation of suspected PAD or who presented with pertinent symptoms were assessed for eligibility. The gold standard was the Ankle-Brachial Index (ABI), which a skilled, experienced operator assessed. There were 102 patients in all (76 men and 26 women). ABI found PAD in 38 patients (37.3%), whereas USG found PAD in 41 patients (40.2%). In contrast to ABI, USG demonstrated an overall diagnostic accuracy of 65.69%, sensitivity of 57.89%, specificity of 70.31%, PPV of 53.66%, and NPV of 73.77%. USG and ABI diagnostic results were significantly correlated. Patients with normotension had the best diagnostic accuracy (75.0%), whereas those with hypertension had the lowest (58.6%). Patients with hypertension, diabetes mellitus, coronary artery disease, and chronic renal disease had significantly greater peak systolic velocities at multiple arterial segments, most consistently in the tibial arteries. ABPI is a highly sensitive tool to screen for peripheral vascular disease in a peripheral location and thus is an appropriate tool for diabetic foot ulcer patients.

Keywords: Color Doppler Imaging, Ankle Brachial Index, Peripheral Arterial Disease

Optimizing Carbohydrate Intake to Enhance Muscle Recovery in Competitive Athletes

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Carbohydrates are the primary fuels during moderate- to high-intensity exercise and are essential for maintaining muscle glycogen reserves. Adequate carbohydrate intake supports glycogen restoration and may help reduce muscle soreness and improve recovery. Emerging evidence demonstrates a consistent and measurable carbohydrate insufficiency among athletes across different training levels, even when protein intake meets recommended requirements. Despite the recognized significance of carbohydrates, there is a scarcity of evidence regarding integrated and target-based carbohydrate interventions for enhancing recovery and performance in athletes. Research indicates 1.0-1.5 g/kg/hour of carbohydrates during the early recovery period as a key component for rapid glycogen restoration. Delaying carbohydrate consumption after exercise has been negatively associated with the rate of glycogen replenishment. Carbohydrate intake alone can efficiently restore glycogen when consumed in ample amounts. However, several athletes fail to meet recommended carbohydrate intakes due to lack of awareness and nutrition education, particularly in terms of requirement standards, timing, and training-based intervention. Current research and clinical trials are mainly based on male athletes and laboratory-based cycling studies, while evidence from female, adolescent, and team-sport athletes remains unexplored. There is also a lack of research directly examining whether structured carbohydrate education and targeted interventions improve objectively measured recovery and performance outcomes. Future research should focus on individualized carbohydrate strategies, carbohydrate periodization, and education programs across different sports and athlete populations. Carbohydrate insufficiency should be recognized as a modifiable factor affecting recovery and performance. Evidence-based, target-oriented carbohydrate planning may help athletes restore glycogen efficiently, improve recovery, and maintain consistent athletic performance.

Keywords: Glycogen restoration, Athlete recovery, Performance optimization, Carbohydrate loading, sports nutrition

Clinical Evaluation of Aspartate Amino Transferase-to-Platelet Ratio Index (APRI) as a Non-Invasive Screening Tool for Liver Cirrhosis in Faisalabad, Punjab, Pakistan

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Hepatitis B and C virus both causes more than 75% of cirrhosis-related morbidity and mortality, developing liver cirrhosis, a major public health burden. Liver biopsy is the diagnostic gold standard, but it is invasive, expensive, and risky, which limits its use in areas with limited resources. APRI provides a clinically useful non-invasive procedure for early liver disease screening and is predicated on routinely available laboratory parameters. The objective of the study is to assess the cost-effectiveness and clinical utility of APRI. A prospective cross-sectional study was conducted at six diagnostic centers in Faisalabad. Adults aged 18-70 with suspected or confirmed liver cirrhosis were selected using non-probability purposive sampling. A total of 275 people were screened, 247 (128 females, 119 males) were selected and patients with a history of dengue, malaria, or blood transfusion, NAFLD, hepatic malignancies, and prior liver transplantation were excluded. APRI was calculated as: (AST ÷ AST Upper Limit of Normal) ÷ Platelet Count (×109/L) × 100. Statistical analyses included Spearman's rho correlation and ROC curve analysis in IBM SPSS. The two most prevalent age groups were 31–45 years old (37.7%) and 46–60 years old (32.8%). The distribution of APRI scores showed that 37 individuals (15.0%) met the ≥2.0 criteria for severe cirrhosis, 73 individuals (29.6%) were above 1.5, indicating significant fibrosis, and 137 normal individuals (55.5%) were <0.5 cut-off. According to Spearman's rho, Platelet count and AST had a strong negative correlation ($r = -0.817$, $p < 0.01$), while APRI had a positive correlation ($r = 0.951$) with AST and a negative correlation ($r = -0.930$) with platelets. An AUC of 1.000 (95% CI: 1.000–1.000; $p < 0.001$) was obtained from ROC curve analysis. APRI showed high diagnostic accuracy for liver cirrhosis in Faisalabad, with strong correlations and perfect ROC classification.

Keywords: Liver cirrhosis, APRI, Non-invasive screening, ROC analysis, Chronic liver disease

From Bench to Bioimpedance: Translating Diabetic Nephropathy Biomarkers into Smart Healthcare Systems

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Diabetic Nephropathy (DN) remains the primary global driver of End-Stage Renal Disease (ESRD), presenting a complex intersection of chronic hyperglycemia, microvascular injury, and metabolic instability. Traditional clinical management relies on periodic laboratory evaluations, inherently failing to capture real-time physiological shifts such as acute fluid overload, dynamic hyperkalemia, and uremic toxin buildup. This article presents an integrated STEAM (Science, Technology, Engineering, Arts, and Mathematics) framework that bridges biochemical discoveries with actionable point-of-care practice. By translating the molecular mechanisms of glomerular injury into a multimodal wearable ecosystem, the proposed system integrates Bioimpedance Spectroscopy (BIS) for early extracellular fluid detection, enzymatic microneedle patches for continuous interstitial tracking of potassium (K) and urea, and conducting polyaniline (PANI) gas sensors for exhaled breath ammonia analysis (*uremic fetor*). These multi-parametric sensor streams are aggregated via low-power edge microcontrollers and processed through Long Short-Term Memory (LSTM) neural networks to forecast hyperkalemic events and acute fluid retention hours before clinical onset. Applying human-centered design principles, biometrics are translated into intuitive, non-stigmatizing interfaces for patients and triaged clinical dashboards for nephrologists. By unifying biochemical sensing, IoT hardware engineering, predictive time-series modeling, and user experience design, this framework demonstrates how multi-disciplinary collaboration accelerates the transition of renal research from laboratory benches to continuous, proactive clinical practice.

Keywords: Diabetic nephropathy, Smart healthcare systems, Microneedle biosensors, Predictive Healthcare AI

Synergistic Protective Effects of Apigenin and Vitamin B2 Against Acetic Acid-induced Acute Colitis through Modulation of Oxidative Stress, Inflammation, and Systemic Biochemical Disturbances

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Inflammatory bowel disease (IBD) involves intestinal inflammation, oxidative stress, and systemic biochemical disturbances. Natural antioxidants such as Apigenin and Vitamin B2 may provide protective effects against colonic inflammation. To evaluate the protective effects of Apigenin and Vitamin B2, individually and in combination, against acetic acid-induced acute colitis in rats. Thirty rats were divided into five groups (n = 6): normal control, colitis control, standard drug, Apigenin, and Apigenin + Vitamin B2. Acute colitis was induced using 2% glacial acetic acid. Treatments were administered orally according to the experimental protocol. Disease activity index, hematological indices, oxidative stress, hepatic and renal function, lipid profile, and serum cortisol were assessed. Acetic acid-induced colitis showed increased disease activity, impaired body-weight metrics, oxidative imbalance, and alterations in hematological and biochemical parameters. Monotherapy with apigenin and combination of apigenin and vitamin B2 improved these changes, where the combined treatment showed greater overall protective effects than individual treatments. Apigenin and vitamin B2 demonstrated promising protective effects against experimental acute colitis, potentially through antioxidant, anti-inflammatory, metabolic, and stress-modulatory mechanisms. The combined administration showed enhanced overall efficacy. Future nutraceutical therapeutics should focus on molecular pathways that mimic natural antioxidant activity and restore anti-inflammatory pool during acute disease progression.

Keywords: Colitis, Inflammatory disease, Intestinal integrity, Mucosal immunity, Nutraceutical therapy, Vitamins

Anti-arthritic and Anti-inflammatory Potential of Curcumin and Vitamin B3 in a Rat Model of Acute Arthritis

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Acute arthritis is an inflammatory condition involving inflammatory responses, pain perception, and biochemical pathways of disease progression. Curcumin, a natural polyphenolic compound, possesses strong antioxidant and anti-inflammatory properties that suppress reactive oxygen species and inflammatory signaling. Vitamin B3, as a cofactor, further reduces oxidative stress and cytokine production while supporting cellular repair mechanisms. This study was designed to evaluate the protective efficacy of Curcumin and Vitamin B3, individually and in combination, against induced acute arthritis in rats. Thirty healthy Wistar rats were randomly sorted into five groups: Negative Control, Positive Control (1% w/v carrageenan; 0.05 mL), Standard Treatment (Indomethacin; 10 mg/kg), Phytochemical treatment (Curcumin; 200 mg/kg), and Combination Treatment (Vitamin B3; 4 mg/kg + Curcumin 200 mg/kg). Arthritis was induced according to the experimental protocol, and physical parameters including body weight, feed intake, and behavioral patterns were monitored. After the trial, biological samples were collected for hematological, serological, and histopathological assessments. Co-administration of Vitamin B3 and Curcumin led to superior suppression of inflammatory markers and greater attenuation of oxidative stress compared to the positive control group. These findings demonstrate that combined Curcumin and Vitamin B3 therapy offers enhanced therapeutic protection against acute arthritis. Given the limitations of standard therapies, identifying novel bioactive combinations remains critical for managing metabolic and inflammatory diseases with minimal side effects.

Keywords: Articular inflammation, Phytotherapy, Vitamins, Nicotinic acid, Cofactor therapeutics

Comparative Assessment of Residual Ridge Resorption in Edentulous Denture Wearers and Non-Wearers

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Residual ridge resorption is a gradual and irreversible physiological remodeling process that occurs after tooth extraction. Mechanical loading, denture pressure, bone metabolism, and systemic factors influence the rate at which bone loss occurs. The presence or absence of dentures alters functional stimulation of the alveolar ridge. The current study was designed to compare the effects of denture wearing on ridge resorption in a general population, keeping diabetes as a dominant factor in influencing ridge resorption in diseased patients. Diabetic patients with autoimmune disorders and osteoporosis and patients having poorly fabricated dentures were included in order to control possible associated factors with alveolar ridge resorption. Ridge height and width were evaluated using the ACP classification in both groups. RRR was assessed and compared in the upper and lower jaws of both groups. The number of participants in the current study was 67 (Denture wearers + non-wearers), with the inclusion criteria of age group (50-80 years), and the timeline for data collection was 3-6 months. The survey data from the ACP classification were collected from OPD patients and subsequently analyzed using standardized and calibrated measurement tools. The collected numerical data were subjected to normality testing and descriptive statistics, including assessment of error recognition and skewness of data. The findings of this research indicate long-term denture use may accelerate resorption through mechanical pressure, altered muscle dynamics, and uneven force distribution. Properly fitting dentures and regular relining are recommended to help maintain residual ridge integrity. Longitudinal studies using CBCT are recommended to further confirm these associations.

Keywords: Ridge resorption, Dental morphology, Mandibular resorption, Osteoporosis, Bone density, Survey-based data

Smart Healthcare Systems: From Natural Bioactive Compound Discovery to Therapeutic Practice: Current Advances, Challenges, and Future Perspectives

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The discovery, evaluation and use of therapeutic agents are undergoing a dramatic shift with the rapid development of smart healthcare systems. Natural products are a source of structurally diverse bioactive compounds that exhibit antioxidant, anti-inflammatory, antimicrobial, metabolic and other pharmacological activities. But the process of moving the identification of natural bioactive compounds into practical healthcare applications entails systematic characterization, validation, standardization and incorporation of the discovered compounds into the healthcare technologies of the modern age. This review addresses the current knowledge on the discovery-to-practice route for natural bioactive compounds in the newly developing smart healthcare systems. The current developments of phytochemical screening, chromatographic and spectroscopic methods, computational techniques, molecular docking, artificial intelligence, and data-driven drug discovery methods are explored to find and prioritize the most promising therapeutic candidates. Variability of natural sources, compound standardization, bioavailability, toxicity assessment, reproducibility and translation from laboratory results to clinical practice are also discussed. The application of AI, precision medicine, digital health technologies and advanced drug delivery systems could enable the transition of 'natural product discovery' to personalized and evidence-based healthcare. Finally, future prospects are reviewed in terms of the collaboration between different disciplines, uniform research pipelines and clinical validation. In conclusion, the integration of Natural Bioactive Compound Discovery and Smart Technologies is a promising approach that holds the potential to create new and innovative healthcare solutions that are sustainable and patient-centered.

Keywords: Natural products, Bioactive compounds, Drug discovery, Precision medicine, Therapeutic applications, Digital health

Optimization and Quality Evaluation of Instant Soup Mix Prepared from Finger Millet Flour

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Instant soup is a suitable product to be developed as a fast food because it is easy and quick to make. The demand for ready food and ready-to-cook food has increased significantly in recent years. Dehydrated soup powders have certain benefits, as they do not suffer loss of nutrients or spoilage under ambient conditions for up to one year. Finger millet is rich in nutrients including minerals, dietary fiber, vitamins and bioactive compounds such as phenolics. Firstly, finger millet flour was analyzed to determine the chemical composition and phenolic profile. Results indicated 8.6% moisture, 2.96% ash, 10.54% crude protein, 9.00% crude fat, 10.90% crude fiber, and 58.1% NFE (nitrogen-free extract). The mineral content was 413.7 mg/kg iron and 239.5 mg/kg calcium. HPLC detected quercetin 0.073 mg/100g DW, gallic acid 0.455mg/100g DW, and caffeic acid 3.203 mg/100g DW. Five soup mix powders with different amounts of finger millet flour were formulated (T_o, T_1, T_2, T_3 and T_4) and evaluated on a 5-point hedonic scale. The highest acceptability was obtained in treatment T_4, which had 44 g finger millet flour. One-Way ANOVA (analysis of variance) was used for the statistical analysis of data. Chemical characterization of T_4 revealed calcium levels of 347.5 mg/kg, iron levels of 300.47 mg/kg, Total phenolics of 107.87 mg GAE/g, Total flavonoids of 36.10 mg QE/g, DPPH (2,2-Diphenyl-1-Picrylhydrazyl) 8.924% and FRAP (ferric reducing antioxidant power) 53.18 mg TE/g. Most of the functional groups were confirmed and successful soup powder formation was confirmed by FTIR (Fourier transform infrared spectroscopy).

Keywords: Finger millet, Soup, Instant mix, HPLC, FTIR.

Ultrasound Assessment of Benign and Malignant Pelvic Lesions in Patients with Lower Abdominal Pain

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Pelvic lesions are major causes of lower abdominal pain present as benign or malignant conditions. Early differentiation of lesions is essential for proper diagnosis, clinical planning and complication control. Ultrasound is considered a primary imaging modality because it is safe, noninvasive, cost-effective, radiation-free, and provides real-time imaging. Sonographic appearances such as lesion morphology, margins, echogenicity, septation, and vascularity differentiating benign from malignant pelvic lesions were assessed. Assessing the efficacy of ultrasound in distinguishing benign and malignant pelvic lesions in female patients' chief complaint with lower abdominal pain and to assess the sonographic features and prevalence of different pelvic lesions. A prevalence study was conducted in the Department of Radiology at MTH and Faisal Hospital for duration of 6 months. A total of 100 patients were included using a non-probability convenient sampling technique. Pelvic ultrasound examinations were performed using a Toshiba Aplio 400 ultrasound machine, and with a curvilinear convex probe with frequency of 3-5 MHz. Findings were analyzed using SPSS version 24. Among 100 patients, the most common age was 35 years. Both ovaries were the most common site of lesion involvement (38%), followed by the uterus (26%), cystic lesions (50%), and mixed lesions 8%. Circular shaped lesions observed 59% well-defined margins were present in 50%. Anechoic echo patterns were observed. 43% septation was absent in 86% while solid components were absent in 80% of cases. Doppler vascularity was absent in 92%. Hydrosalpinx and endometriomas were observed in 20%. Overall benign lesions accounted for 70% intermediate lesions, 22%, and malignant lesions 8%. USG considered being an effective primary imaging modality for evaluating pelvic lesions in females with lower abdominal pain. Ultrasound essential role in early identifies, lesion characterization, and treatment of pelvic lesions.

Keywords: Pelvic lesions, Mlignant lesion, Benign lesion

Childhood Autism and Dietary Rigidity: Prevalence and Expression Patterns

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Dietary rigidity (DR) is among the most common feeding problems experienced by children with Autism Spectrum Disorder (ASD) and is frequently linked to sensory sensitivities, behavioural rigidity and nutritional deficiencies. This systematic review aimed to assess the prevalence, patterns, etiological mechanisms and nutritional consequences of dietary rigidity among children with ASD. The review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic literature search was carried out in the databases PubMed, Scopus and Google Scholar for studies published between 2014 and 2025. Eligible studies reported on children aged 3–18 years with clinically diagnosed ASD and the prevalence and determinants and outcomes of dietary rigidity. A total of 512 records were screened, duplicates removed, and 34 studies were eligible for inclusion. Results show that the prevalence of dietary rigidity in children with ASD is high. Reported prevalence ranged from 21% to 89%. Sensory processing abnormalities, particularly hypersensitivity to food texture, taste, smell, and appearance, were found to be significant contributors to restrictive eating behaviours. Rigid eating patterns were further exacerbated by behavioural inflexibility, insistence on sameness and food neophobia. Common nutritional outcomes were deficiencies in dietary fibre, iron, calcium, and vitamins D and E. Gastrointestinal problems included constipation and abdominal discomfort. Additional evidence suggested links between dietary rigidity, altered gut microbiota and mealtime behavioural problems. According to the review, dietary rigidity in ASD is a complicated phenomenon with significant nutritional and developmental ramifications. Early screening and multimodal interventions (dietary management, sensory integration therapy, and behavioural approaches are needed to improve dietary diversity, improve nutritional status, and improve the overall quality of life of children with ASD.

Keywords: Autism, Dietary rigidity, Autism spectrum disorder, neurodevelopmental condition, Sensory integration therapy

From Search Engines to AI Answers: Does Conversational AI Increase or Decrease Cyberchondria? A Cross-Sectional Study in the General Population of Pakistan

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For about twenty years, people have looked up health information on web search engines, a habit linked to cyberchondria, where repeated symptom searching raises health anxiety instead of easing it. This study examined how a person's main source of online health information relates to cyberchondria severity in the general population of Pakistan. We ran a cross-sectional online survey on Google Forms using convenience and snowball sampling and followed the STROBE checklist. The questionnaire combined the validated 12-item Cyberchondria Severity Scale (CSS-12) with researcher-developed items on demographics, digital competence, AI use and trust in AI. Respondents were grouped as AI-dominant, search-dominant, mixed or low users according to how much they relied on chatbots versus search engines to check symptoms. Data were analysed with the Kruskal–Wallis test and Spearman correlation. Of 221 participants, 219 gave complete responses; most were aged 18–25 years (91.3%) and were students (87.7%). The mean CSS-12 score was 32.9±8.5. Severity differed between groups ($H=10.01$, $p=0.007$). Mixed users scored highest (n=56; 37.9±7.9) and low users lowest (n=89; 29.2±8.0), while AI-dominant (n=31; 33.5±7.5) and search-dominant users (n=43; 33.7±7.2) scored about the same. Trust in AI was not correlated with severity ($\rho=-0.10$, $p=0.15$). About two in five respondents (39.7%) had used a chatbot to self-diagnose, and 28.8% said an AI self-assessment prompted them to see a health professional. Cyberchondria was highest when people used AI together with traditional search, suggesting that conflicting information from several sources, rather than the AI answer format itself, may drive health anxiety. As informal AI use grows, AI tools and digital health literacy programmes should include safety messages.

Keywords: Cyberchondria, Conversational AI, Large language models, Health information seeking, Health anxiety

Prevalence of Substandard and Falsified Medicines in South and Southeast Asia: A Systematic Review and Meta-Analysis

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Substandard and falsified medicines can fail to treat disease, cause harm and add to antimicrobial resistance. Recent pooled estimates cover Africa, but no current estimate exists for South and Southeast Asia across all therapeutic classes. This systematic review and meta-analysis estimated how many medicines sold in the 19 countries of the region fail laboratory quality tests. We searched PubMed, Lens.org and Europe PMC and ran targeted web searches for studies published from 2010 onward that tested medicine samples collected in the region against a pharmacopoeia or registered specification. A second reviewer independently screened a sample of records and checked the extracted data. Study quality was appraised with items adapted from the MEDQUARG guidelines, proportions were pooled with a random-effects generalized linear mixed model, and certainty of evidence was rated with a grade. The primary analysis used field surveys that sampled medicines from the market; small brand-comparison studies were analyzed separately. Forty-nine studies from 12 countries were included. Across 31 field surveys with about 53,000 samples, roughly one in eight samples (about 12%) failed at least one quality test, although results varied widely between settings. Most failures were substandard products from registered manufacturers. Falsified products were rare overall but concentrated in a few markets. Prevalence was similar in South and Southeast Asia, and research surveys found more failures than national regulatory data. Seven countries had no eligible data, and none of the five studies from Pakistan were suitable for the primary analysis. Certainty of the evidence was low. Poor-quality medicines are common in the region, and most are substandard rather than fake, which suggests that manufacturing and storage deserve as much attention as counterfeiting. Random-sample national surveys are needed, particularly in Pakistan. These results are preliminary while the analysis is being finalized.

Keywords: Substandard medicines, Falsified medicines, Prevalence, Meta-analysis, South and Southeast Asia

Transparent Healthcare Analytics Using Federated Learning and Explainable AI for Smoker Prediction

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Cardiovascular diseases, respiratory disorders, cancer and other long-term health issues are all linked to smoking. With sufficient healthcare data, smoking-related health trends can be identified early, helping to support preventive and data-driven healthcare decision making. But traditional centralised machine learning methods might suffer from privacy issues with sensitive health data and the explainability of predictive models. This study introduces a novel hybrid approach of Federated Learning (FL) and Explainable AI to build a smoker health classification system that is private and explainable. The dataset Smokers Health was downloaded from Kaggle: classify an individual as a smoker or a non-smoker. A federated learning framework was implemented, with two supervised machine learning classifiers (KNN and Bernoulli Naive Bayes (BernoulliNB)) that do not require the sharing of raw healthcare data. These two methods LIME and SHAP were also used to give local and global explanations for the predictions of the model. Experimental results showed that high accuracy was obtained for both classifiers. KNN obtained 98.10% training accuracy, 96.41% testing accuracy and ROC-AUC 0.975 while BernoulliNB obtained 97.69% training accuracy and 97.18% testing accuracy and ROC-AUC 0.974. The federated models provided good classification results and also improved healthcare data privacy. The analysis of explainability revealed the following factors as relevant predictors: cigarettes per day, cholesterol level, age, heart rate and blood pressure, with the variable cigarettes per day being the most influential feature. The results show the potential of FL and explainable machine learning to offer a privacy-preserving, interpretable and accurate classification system of smokers.

Keywords: Machine learning, Federated learning, XAI, Healthcare analytics, Smoker health classification

Macular Volume and Retinal Nerve Fiber Layer Thickness in Mild, Moderate and High Myopia

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Myopia is a growing global public health concern, affecting an estimated 2.6 billion people worldwide in 2020, with projections suggesting that nearly half of the global population (49.8%) may be affected by 2050. High myopia is also projected to increase substantially, reaching approximately 938 million people by 2050, increasing the potential burden of retinal and optic nerve complications. This study aimed to compare macular volume and retinal nerve fiber layer (RNFL) thickness among individuals with mild, moderate, and high myopia and to evaluate their association with increasing myopia severity. A cross-sectional comparative study was conducted at Sehat Medical Complex from January to June 2025. A total of 124 participants aged 18–45 years were categorized according to spherical equivalent refractive error into mild (>−3.00 to ≤−0.50 D), moderate (>−6.00 to ≤−3.00 D), and high myopia (<−6.00 D). Spectral-domain optical coherence tomography (SD-OCT) was used to assess macular volume and peripapillary RNFL thickness. One-way ANOVA followed by Tukey's HSD post-hoc test was performed. Of the 124 participants, 69 (55.6%) were males and 55 (44.4%) were females, with a mean age of 30.96 years. Mean RNFL thickness was 99.70 ± 6.28 µm, 85.48 ± 2.64 µm, and 74.77 ± 2.15 µm in mild, moderate, and high myopia, respectively. Mean macular volume was 8.20 ± 0.44, 8.11 ± 0.39, and 7.72 ± 0.70 mm^3, respectively. RNFL thickness differed significantly among groups ($F=374.129$, $p<0.001$), showing progressive thinning with increasing myopia. Macular volume also differed significantly ($F=14.323$, $p<0.001$) and decreased with increasing myopia. Post-hoc analysis demonstrated significant macular volume differences between mild and high and between moderate and high myopia. Increasing myopia severity is therefore associated with progressive retinal structural changes, particularly marked RNFL thinning and reduced macular volume in high myopia, highlighting the potential value of SD-OCT for monitoring retinal changes.

Keywords: Myopia, Macula Lutea, Optical Coherence Tomography, Retinal Nerve Fiber Layer

Exploring the Relationship Between Visual Attention to Emotional Faces in Children with and Without Autism Spectrum Disorder in Pakistan

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Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by difficulties in social communication and emotional processing. The aim of this study was to compare visual attention patterns in children with and without autism spectrum disorder. A comparative cross-sectional study was conducted on 42 participants, divided into two groups: 21 ASD were recruited from an autism rehabilitation school, and 21 TD were recruited from mainstream school aged between 6-14 years. The TD group served as comparison group. Standardized emotional facial stimuli (happy, sad, angry, afraid, and neutral) were utilized with the Web Gazer eye-tracking system. Each facial stimulus was presented for 5 seconds and the complete eye-tracking assessment was approximately 10-15 minutes for each participant. The eye-tracking metrics employed were fixation time, total fixation, number of fixations, and X and Y coordinates of the average gaze. Data was analyzed using SPSS version 26. Statistically significant differences were observed in all eye-tracking measures between the ASD and TD groups ($p<0.001$) including Fixation count ($r=0.82$, $p<0.001$), Fixation duration ($r=0.79$, $p<0.001$), and Gaze coordinates ($r=0.83$, $p<0.001$). The findings demonstrated that children with Autism Spectrum Disorder display atypical pattern during emotional face processing hence, Webcam based eye-tracking may serve as feasible approach for assessing social attention and support future early screening on ASD. These findings improve understanding of visual attention differences during emotional face processing in children with ASD and provide evidence supporting the potential use of eye-tracking as an objective approach for assessing social attention.

Keywords: Autism Spectrum Disorder, Eye-tracking, Visual attention

Diagnosis and Classification of Diabetic Retinopathy Using Deep Learning with Explainable Artificial Intelligence

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In the world, around one-forty billion people are affected by type 1 and type 2 diabetes. The most common complication of type 2 diabetes is Diabetic Retinopathy, that eventually results in blindness. Timely intervention to manage this disease with the help of regular screening and fundus photography. Experienced optometry physicians are required to diagnose DR, but the availability of these individuals is very low in count. So, in order to cop this situation, the purpose of this study is to diagnose Diabetic Retinopathy by using Deep learning with Explainable AI. Compare three Deep learning CNN models, ResNet50, VGG19, and VGG16 for the task of classification and diagnosis of DR based on severity level using fundus images of retina. A fine-tuned approach was implemented for these three models on a provided dataset where the severity of DR was divided into five principal categories: No Diabetic Retinopathy, Mild Non-Proliferative DR, Moderate NPDR, Severe Non-Proliferative DR, and Proliferative DR. The performance of VGG16 achieved the highest accuracy, as compared to ResNet50 and VGG19. A combination of XAI techniques, LIME and Grad-CAM, was employed here to offer visual representation of the defective regions in the retinal images that helped the models decision-making. These techniques expose the decision-making flow, and thus it becomes easier for the optometry physician to trust and cross-verify the AI's decisions. These models are highly effective in DR detection as per the study results, with VGG16 having more discriminative power and VGG19 scoring better in F1-score, precision and recall. The authors recognize the enormous potential of pre-trained Deep learning CNN models, ResNet50, VGG16, and VGG19, to revolutionize DR screening, but they also emphasize the need for more work on testing and optimization to confirm the models' readiness for deployment in actual clinical situations.

Keywords: Diabetic Retinopathy (DR), Convolutional Neural Networks, Deep Learning (DL) Models

Comparative Prevalence of Early-Onset Cataract Among Smokers and Non-Smokers: Role of Lifestyle Factors in a Cross-Sectional Study

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Cataract is one of the leading causes of visual loss, and is now known to be a problem in adults under the age of 60 years. Early onset cataract can negatively impact occupational performance, quality of life and health care expenses. Smoking could be a contributing factor due to oxidative stress, decreased antioxidant defense and damage to the lens and other lifestyle and metabolic factors could play a role in risk. The aim of this study is to find out the prevalence of early onset cataract in smokers and non-smokers within the age group of 30-60 years in Lahore, Pakistan and investigate the independent association of smoking, lifestyle and selected clinical factors with cataract. The methods used were analytical cross-sectional study, which included 200 adult population 30-60 years in Lahore. Stratified sampling was done based on smoking status. Odds ratios (ORs) and 95% confidence intervals (CIs) were presented and $p<0.05$ was considered significant. Sixty-eight (34.0%) of participants had early-onset cataract. The highest prevalence was among current smokers (51.5%), followed by former smokers (41.7%) and never smokers (19.4%) ($p < 0.001$). Current smoking (AOR = 4.133; 95% CI: 1.880–9.086) and former smoking (AOR = 3.436; 95% CI: 1.346–8.771) were independently associated with cataract. Diabetes, low consumption of fruits, vegetables, obesity, poor sleep, low consumption of water were also associated independently with early onset cataract. Smoking and some lifestyle and metabolic factors were significantly correlated with early onset cataract. Prevention of cataract burden in adults under 60 years old may be achieved through smoking cessation, healthier lifestyle, metabolic risk management and early screening for eye-health.

Keywords: Early-onset cataract, Smoking, Lifestyle factors, Oxidative stress, Diabetes

Renal Vascular Doppler Indices and Carotid Artery Intima Media Thickness in Diabetic and Non Diabetic Patients

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Diabetes mellitus initiates early microvascular and macrovascular changes detectable through non-invasive imaging tools. Renal Doppler indices, involving resistive and pulsatility indices, represent intrarenal vascular resistance, while carotid intima-media thickness reflects an established indicator of systemic atherosclerosis. Comparative evaluation of these factors may assist in early detection of vascular changes and clarify their relation to cardiovascular and renal risk. This study aimed to compare renal vascular Doppler indices and carotid intima-media thickness between diabetic and non-diabetic patients. A case-control study was performed at a tertiary care hospital involving 120 adults aged 18 to 50 years, involving both males and females. Individuals were equally classified into a diabetic group of 60 cases and a non-diabetic group of 60 controls. Stratified random sampling was implemented to maintain balanced gender distribution, and measurements were evaluated using standardized imaging protocols. Carotid intima-media thickness was positively correlated with diabetes, demonstrating a mean elevation of 0.08 with a t-value of 3.25 compared to non-diabetic individuals. In contrast, common carotid and internal carotid artery indices were negatively associated with diabetes, with mean differences of -11.60 and -5.19 and t-values of -5.32 and -2.57, respectively. Renal vascular Doppler indices were positively correlated with diabetes, exhibiting a mean difference of 3.33 and t-value of 2.00. Significant differences were noticed in both renal indices and carotid thickness between groups. Diabetic patients showed increased renal Doppler indices and elevated carotid thickness, indicating early vascular and atherosclerotic changes related to diabetes. These findings reinforce the value of renal Doppler and carotid thickness as a beneficial non-invasive modality for early detection of vascular involvement in diabetic patients.

Keywords: Pulsatility Index, Renal Resistivity Index, Systolic/Diastolic, Carotid Intima Media Thickness

AI-Driven Lipid-Based Nano-carriers as a Paradigm Shift in Metabolic Disease Treatment: Possibilities and Challenges of Next-Generation Targeted Drug Delivery to mRNA Therapeutics

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Metabolic disorders, including diabetes, obesity, hypertension, dyslipidemia, and Metabolic The integration of artificial intelligence (AI) with lipid nano-carrier engineering is now driving a paradigm shift toward next-generation targeted drug delivery, particularly for mRNA therapeutics, offering unprecedented opportunities for precision medicine in metabolic diseases. This review critically examines the possibilities and challenges of AI-driven LNPs as targeted mRNA delivery platforms. This review systematically examines recent advances in lipid-based nanocarrier systems, including liposomes, SLNs, nanostructured lipid carriers (NLCs), hybrid formulations, and mRNA-LNP platforms, across a spectrum of metabolic conditions, from thyroid dysfunction to hypertension and MAFLD. Mechanistic insights into cellular uptake pathways and tissue-specific targeting are critically evaluated. Lipid nanoparticles demonstrated remarkable versatility and efficacy across multiple therapeutic domains. For thyroid disorders, ultrasensitive nanoparticle-based immunoassays achieved detection limits of 60 nU L^{-1} for thyroid-stimulating hormone, while selenium- and cepharanthine-loaded polymeric systems effectively targeted autoimmune thyroiditis. These nano-carriers consistently demonstrated enhanced pharmacokinetic profiles, controlled release kinetics, and reduced off-target effects compared with conventional formulations. In parallel, AI-driven strategies are beginning to enable high-throughput lipid library screening, prediction of transfection efficiency and organ-selective delivery, and rational design of mRNA-LNPs with improved potency and safety, although clinical validation remains limited. Continued innovation in AI-guided lipid nanoparticle engineering holds immense potential for developing patient-personalized, effective mRNA therapeutics for the growing epidemic of metabolic diseases.

Keywords: Metabolic disorders, targeted drug delivery, mRNA therapeutics, precision nanomedicine, machine learning

Comparative Effectiveness of Petrissage Soft Tissue Mobilization and Friction Massage on Pain and Functional Disability in Adults with Cervical Radiculopathy: A Randomized Clinical Trial

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Cervical radiculopathy is a prevalent musculoskeletal disorder arising from the compression or irritation of cervical nerve roots, causing symptoms such as neck pain, neurological manifestations, and functional deficits. Manual therapy modalities are often employed in its treatment. However, there is uncertainty regarding the relative efficacy of various manual therapy modalities. The objective of the study as to compare the effects of Petrissage soft tissue mobilization versus friction massage on pain intensity and functional disability in adults diagnosed with cervical radiculopathy. The study involved conducting a clinical trial of randomized nature on 54 patients suffering from cervical radiculopathy. The subjects were divided into two equal groups containing 27 patients in each group. Group A was subjected to soft tissue mobilization petrissage technique, while Group B was subjected to friction massage technique along with the conventional physiotherapy treatment. Pain levels were measured with the help of visual analogue scale (VAS), while the level of disability was evaluated by neck disability index (NDI). Pain and functional disability significantly reduced for both groups ($p<0.001$). The VAS scores were reduced to 2.85 ± 0.98 from 7.18 ± 1.10 in Group A and from 7.05 ± 1.22 to 3.92 ± 1.18 in Group B. After treatment, there was a significant reduction in pain scores for Group A ($p=0.002$). In addition, the NDI scores were significantly lowered from 32.11 ± 6.74 to 14.22 ± 5.48 for Group A and from 31.76 ± 7.05 to 18.63 ± 6.12 for Group B. Both the petrissage soft tissue mobilization and friction massage techniques have been found to be useful in reducing the pain as well as functional disability among people suffering from cervical radiculopathy. However, it appears that the petrissage technique has resulted in more significant benefits when compared to friction massage. This shows that petrissage is more beneficial clinically because of its wide physiological effects.

Keywords: Cervical radiculopathy, Petrissage, Friction massage, Pain

ISLAMIC PERSPECTIVE FOR FUTURE READY SOCIETIES

ORAL

PRESENTATIONS

Islamic Education and Technology: Preparing Students for the Future

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The rapid development of modern technology, particularly Artificial Intelligence, digital learning platforms, educational applications, social media, and online communication, is significantly transforming the ways in which students acquire, process, and share knowledge. These technological developments have created new opportunities for education by making learning more accessible, interactive, flexible, and engaging. Islamic education also needs to respond to these changes while preserving its fundamental values, ethical principles, spiritual objectives, and emphasis on character building. This paper explores how technology can be effectively integrated into Islamic education to prepare students for future academic, professional, and social challenges. It argues that technology should not merely be considered a teaching tool but should be guided by Islamic values such as honesty, responsibility, respect, justice, moderation, accountability, and the pursuit of beneficial knowledge. Digital resources, online libraries, interactive learning platforms, multimedia content, educational applications, and Artificial Intelligence can support students in understanding Islamic teachings and connecting classical knowledge with contemporary issues. However, technological advancement also creates challenges, including misinformation, digital distraction, plagiarism, privacy concerns, inappropriate online content, and the uncritical use of Artificial Intelligence. Therefore, students require proper ethical and intellectual guidance to use technology responsibly and constructively. The study adopts a qualitative and conceptual approach by examining Islamic teachings related to knowledge, education, character development, responsibility, and the beneficial use of resources within the context of modern technological developments. The paper proposes that a balanced educational approach combining technological literacy with Islamic moral and spiritual education can help develop confident, ethical, creative, critical-thinking, and responsible students. Such an approach can contribute to the development of future-ready societies in which technological progress remains connected with human dignity, ethical responsibility, spiritual well-being, and the broader welfare of individuals and communities.

Keywords: Islamic Education, Technology, Artificial Intelligence, Students, Islamic Ethics

Human Rights and Social Justice in Future Societies: An Islamic Perspective

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The emergence of future societies shaped by artificial intelligence, digital transformation, globalization, technological innovation, and economic change has created new possibilities as well as significant challenges for human rights and social justice. While technological advancement can improve human life, it may also generate new forms of inequality, discrimination, exclusion, privacy violations, and social marginalization. Therefore, future-ready societies require an ethical framework that places human dignity, equality, justice, and social responsibility at the center of development. Islam provides a comprehensive moral and legal framework for addressing these challenges through the Qur'an, Sunnah, and the objectives of Islamic law. This research examines the Islamic perspective on human rights and social justice in the context of emerging future societies. It explores fundamental Islamic principles such as human dignity, justice, equality, freedom, compassion, accountability, and the protection of essential human interests. The Qur'an emphasizes justice and prohibits discrimination, exploitation, oppression, and social injustice, while the life and teachings of Prophet Muhammad ﷺ provide practical examples of protecting human rights and promoting social harmony. It argues that technological progress without ethical responsibility may increase social inequalities. The principles of Maqaṣid al-Shariah can provide a valuable framework for ensuring that technological and social development remains focused on human welfare and dignity. Using a qualitative and analytical methodology, the research draws upon the Qur'an, Hadith, classical Islamic scholarship, and contemporary literature on human rights and social justice. The study concludes that Islamic principles can contribute significantly to the development of future societies that are technologically progressive, socially inclusive, ethically responsible, and committed to justice and human dignity.

Keywords: Artificial intelligence, Social justice, Human rights, Maqaṣid al-Shariah, Qur'an, Human dignity

Future-Ready Muslim Youth: Islamic Responses to AI, Digital Transformation, Identity, and Emerging Ethical Challenges

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The rapid advancement of Artificial Intelligence (AI), digital technologies, social media, and virtual environments is transforming the ways young people learn, communicate, work, construct identities, and participate in society. These developments offer unprecedented opportunities for knowledge, creativity, innovation, and social connectivity, while simultaneously generating emerging ethical challenges related to misinformation, privacy, algorithmic influence, digital addiction, identity formation, human autonomy, and the responsible use of technology. In Muslim societies, these transformations raise an important question: how can Islamic teachings equip young people to engage confidently and ethically with an increasingly technology-driven future? This study explores an Islamic framework for developing future-ready Muslim youth by examining relevant principles from the Qur'an, Sunnah, Islamic ethics, and Maqaṣid al-Shariah. It argues that future readiness should extend beyond technological competence to include moral reasoning, spiritual awareness, critical thinking, responsible digital citizenship, and the ability to navigate emerging technologies without compromising human dignity and Islamic values. Particular attention is given to the role of Islamic education in preparing youth to critically evaluate AI-generated information, resist digital manipulation, protect personal and communal values, and make ethically responsible decisions in virtual and physical spaces. The study proposes that Islamic principles of ilm (knowledge), amanah (responsibility), ḥurmah-e-insani (human dignity), taqwa (God-consciousness), and maslaḥah (public benefit) can provide a meaningful ethical foundation for navigating technological transformation. It concludes that integrating Islamic moral education with digital literacy and future-oriented skills can contribute to the formation of resilient, responsible, and ethically conscious Muslim youth capable of contributing positively to future-ready societies.

Keywords: Future-Ready muslim youth, Islamic responses, AI, Future-ready Society, Identity

Social Cohesion, Pluralism, and the Future of Muslim Societies: An Islamic Perspective for STEAM-Driven Futures

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The progress in science, technology, engineering, arts and mathematics (STEAM) will influence future Muslim societies, along with cultural and religious pluralism. In this paper, I will explore how Islamic principles can contribute to cohesive and inclusive future ready societies. Islam teaches that diversity is a gift from Allah: "O mankind, We created you from male and female and made you peoples and tribes that you may know one another" (Qur'an 49:13). This does not define pluralism in terms of tolerance, but as a moral call for mutual recognition and cooperation. The example of Medina, under the leadership of the Prophetic community, is a paradigm of a multi-ethnic community united in a common covenant, justice, and responsibility. Central is Wasatiyyah (moderation), it is against extremism, exclusion and for engagement with difference. According to the paper, the three pillars of social cohesion in Muslim societies are ethical governance based on Shura (consultation), Amanah (trust), and Adl (justice); inclusive education based on the integration of Islamic values with STEAM competencies, critical thinking, empathy and innovation; and use of digital technologies and arts for building bridges and not polarization. It discusses the goal of the Shariah (Maqasid al-Shariah) in safeguarding the five pillars of peace: religion, life, intellect, family and property. Islamic social ethics provide solutions for challenges like sectarianism, Islamophobia, digital misinformation and economic inequality. It outlines a vision to bring these values to life for communities, educators, and policymakers. The paper argues that future Muslim societies could be examples of pluralistic cohesion if they are able to return to Islam's universal message of justice, dignity and mercy and use STEAM to achieve human flourishing and peaceful living.

Keywords: Social Cohesion, Pluralism, Muslim societies, Wasatiyyah, STEAM, Maqasid Al-Shariah, Future-Ready Societies

Establishing Sustainable Peace in Future Multi-Religious Societies: An Applied Study in Light of the Social Principles of the Charter of Medina

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The Charter of Medina was framed for a city whose residents followed different religions and belonged to different tribes. Muslims, Jewish tribes, and pagan clans were recognized as distinct communities, yet they accepted common obligations concerning security, public order, and justice. This arrangement has relevance for contemporary societies shaped by migration and demographic change, where religious diversity often exists alongside sectarian suspicion and political polarization. The present study examines the social principles of the Charter and considers their application to these conditions. It reads the covenant's clauses and related historical reports in a descriptive and analytical manner. Equal civic standing, shared responsibility for the safety of the city, and freedom of conscience form the central areas of analysis. The discussion shows that peace cannot be maintained by simply asking communities to tolerate one another. It requires institutions that apply the law fairly and protect the rights of every group. The Medinan model also indicates that civic unity does not require the removal of religious difference. A common covenant can hold diverse communities together when it is supported by mutual trust, accountable leadership, and respect for human dignity. These principles offer a practical basis for stable relations in future multi-religious societies.

Keywords: Charter of Medina, Multi-religious societies, Social peace, Pluralism, future-ready communities

Integrating Sustainability, Climate Action, and Green Innovation in STEAM Education: A Descriptive-Analytical Framework

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The escalating global climate crisis necessitates transformative educational approaches that move beyond conventional, compartmentalized models of teaching and learning. This study examines how sustainability, climate action, and green innovation are integrated into Science, Technology, Engineering, Arts, and Mathematics (STEAM) education. A qualitative descriptive analytical approach was employed through a systematic thematic review of contemporary peer-reviewed STEAM literature and institutional curriculum frameworks. The study explores how transdisciplinary educational models foster eco literacy, critical problem solving, and proactive environmental awareness among learners. Findings indicate that project-based STEAM interventions can effectively connect theoretical knowledge with context-specific climate action. The integration of arts and design thinking further enhances this approach by humanizing technical concepts, promoting ethical responsibility, and facilitating the communication of complex environmental issues in accessible and actionable ways. However, rigid curricular structures, limited educational resources, and inadequate professional development opportunities for teachers in interdisciplinary pedagogy constrain the effective implementation of green STEAM education. To address these challenges, the study proposes a policy-aligned and adaptable instructional framework based on three key pillars: context-responsive curriculum adaptation, interdisciplinary capacity building for educators, and community-driven green innovation projects. The proposed framework provides practical directions for educators, curriculum developers, and academic policymakers to promote scalable and contextually relevant green STEAM practices, ultimately supporting the development of environmentally responsible learners capable of contributing to sustainable societal transformation. Future research should evaluate the long-term impact of green STEAM initiatives across diverse educational and cultural contexts. Such evidence can help refine implementation strategies and strengthen the role of education in achieving global sustainability goals.

Keywords: STEAM Education, Climate action, Green innovation, Eco-Literacy, education for sustainable development

Socio-Economic Role of Women in Building a Future-Ready Welfare Society: An Analytical Review in the Context of Shariah Framework and Contemporary Challenges

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The Prophetic period shows that women could contribute to learning, trade, health care, and community welfare while observing their religious and family responsibilities. Contemporary Muslim women face a different set of pressures. Some workplaces exploit their labour and disregard family needs, whereas restrictive customs prevent many women from using their abilities in public and economic life. This study examines the conditions needed for women's socio-economic participation in a future-ready welfare society. It reads Islamic legal sources alongside current questions about employment, remote work, and financial independence. Islamic jurisprudence recognizes a woman's right to own property, earn income, and conduct lawful business. It also requires arrangements that protect dignity, modesty, family rights, and freedom from exploitation. The central issue is therefore not whether women must choose between family life and economic activity. It is whether institutions can support both without treating one as a threat to the other. Safe workplaces, fair financial arrangements, flexible employment, and family services can provide that support. Under such conditions, women can contribute to poverty reduction, education, civic improvement, and community care. A welfare society is better served when women's participation is protected by ethical rules and family life is supported through practical policy rather than used as a reason for exclusion.

Keywords: Islamic Shariah, Women in Islam, Socio-economic welfare, Family stability

Preserving Human Values and Ethics in the Age of Artificial Intelligence: An Analytical Study of Future-Ready Societies in Light of Maqasid Al-Shariah

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Artificial intelligence is entering areas of life that were once governed by direct human judgment. It now affects employment, communication, access to services, and the handling of personal information. These changes raise questions about fairness, privacy, responsibility, and the place of human agency. This study examines such questions through Maqasid al-Shari'ah, focusing on the protection of intellect, human dignity, and public welfare. Its qualitative and inductive-analytical approach places classical Islamic principles alongside present concerns about algorithmic bias, digital surveillance, and also social isolation. An automated decision may appear neutral while reproducing errors or discrimination contained in its data and design. Efficiency, therefore, cannot be the only measure by which a system is judged. The higher objectives of Shari'ah provide grounds for assessing the benefits of artificial intelligence as well as the harm it may cause. Decisions that affect people's rights and opportunities must remain open to human review and institutional accountability. Future-ready societies need clear rules for data use, ethical assessment, and responsibility when automated systems produce unjust outcomes. Artificial intelligence can assist social and economic life when it serves human dignity. It becomes harmful when technical systems are allowed to replace the moral judgment on which public trust depends.

Keywords: Artificial intelligence, Future-ready societies, Human dignity, Maqasid al-Shari'ah, Social ethics

Human Intelligence, Artificial Systems, and the Future of Society: Reclaiming the Qur'anic Paradigm of ʿAql and Hikmah

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As advanced computational technologies and automated systems reshape the foundational dynamics of knowledge, governance, and human interaction, contemporary societies face a profound existential inquiry: what constitutes the true essence of human intellect when machines simulate computation, reasoning, and generation at unprecedented scales? For Islamic scholarship and future-ready societies, this technological frontier demands far more than passive adoption or reactionary rejection—it calls for a rigorous, principled epistemological response anchored in the Qur'an. This keynote address establishes a robust Qur'anic framework for human intelligence as an indispensable compass for building ethically grounded, resilient societies. Utilizing a qualitative hermeneutical inquiry, the study deconstructs foundational Qur'anic constructs—ʿAql (intellect), Tafakkur (critical reflection), Tadabbur (deep contemplation), and Hikmah (divine-inspired wisdom)—while contrasting them with modern algorithmic and automated models. It demonstrates that while automated systems excel at data synthesis and pattern processing, human intellect within the Qur'anic worldview is inherently intertwined with moral agency, spiritual consciousness (Tazkiyah), and ultimate existential purpose. The address contends that future-ready educational and social institutions must not merely chase technical efficiency or compete with machine speed; rather, they must cultivate epistemic depth, moral responsibility, and ethical stewardship (Khilafah). By synthesizing Qur'anic epistemology with contemporary socio-technological realities, this paper articulates an integrative pedagogical paradigm that empowers scholars and academic institutions to guide future societies toward technological innovation without ever compromising human dignity and moral integrity.

Keywords: Qur'anic, Hermeneutics, Advanced computing, ʿAql, Hikmah, Islamic, epistemology

Educating for Character in Future-Ready Societies: Reconsidering the Purpose of Education Through Islamic Intellectual Thought

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Modern educational structures increasingly align with the demands of technological automation, evolving labor markets, and widespread digitization. Within this framework, educational outcomes are heavily measured through technical competency, market-driven skills, and economic productivity. However, this functionalist orientation creates a significant imbalance: it neglects the ethical, moral, and spiritual development of the individual—an essential element for sustaining stable and just human societies. This study re-examines the primary purpose of education through classical and contemporary Islamic intellectual thought, arguing that character formation is a fundamental prerequisite for building resilient future societies. Focusing on the organic relationship between knowledge (*ʿIlm*), moral virtue (*Akhlāq*), social duty, and human flourishing (*Falāḥ*), the paper provides an academic critique of purely utility-driven education through a qualitative and comparative approach. The paper asserts that technical competence without moral formation expands human capability without securing ethical responsibility, leaving modern institutions vulnerable to moral and social decay. Conversely, Islamic educational philosophy treats intellectual growth and moral integrity as inseparable dimensions of learning. The study outlines a balanced educational framework in which modern technical skills, critical analysis, and digital tools are firmly grounded in personal integrity, empathy, self-discipline, and civic accountability. The findings demonstrate that developing future-ready societies requires an educational vision that looks beyond mere skill acquisition to the moral principles guiding how knowledge is applied. This study provides key insights for academics, curriculum designers, and educational institutions striving to synthesize modern technical competencies with enduring Islamic ethical values.

Keywords: Islamic philosophy of education, Character cultivation, *ʿIlm*, *Akhlāq*, *Falāḥ*, Future-ready societies, Educational ethics

Preservation of Moral Values in the Era of Digital Society Advancement and Social Media: An Islamic Perspective

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The contemporary transition into a hyper-connected digital society represents a significant stage in human advancement. The rapid expansion of social media, digital communication, and artificial intelligence has facilitated access to knowledge and strengthened global connectivity. However, it has also created serious ethical challenges, including misinformation, cyberbullying, invasion of privacy, online hatred, and a decline in empathy. These challenges threaten social cohesion and the sustainability of human relationships. Situated within the broader discourse of "Future-Ready Societies," this study critically examines these digital-age ethical challenges through an Islamic framework. The research adopts a qualitative and analytical methodology based on the Qur'an, Sunnah, and the higher objectives of Islamic law (Maqasid al-Shariah). It explores Islamic principles relevant to responsible digital behavior, particularly Tabayyun (verification of information), the prohibition of Gheebah (backbiting) and Buhtan (slander), and the protection of human dignity, privacy, and honor (Hifz al-Ird). The study further examines how these principles can guide individuals in navigating contemporary digital spaces. The findings suggest that technological development alone cannot ensure a genuinely future-ready society. Sustainable digital progress requires ethical responsibility, self-accountability (Muhasabah), truthfulness, respect, and concern for human welfare. The study proposes an Islamic digital-ethical framework, referred to as "Digital Adab," to promote responsible and mindful use of technology. It concludes that integrating Islamic moral values with technological advancement can strengthen social harmony, protect human dignity, reduce digital harms, and contribute to a resilient, peaceful, and sustainable future society.

Keywords: Digital society, Social media ethics, Maqasid al-Shariah, Preservation of moral values, Future ready societies, Societal advancement, Digital adab (Digital Ethics), Islamic perspective, Social sustainability

Application and Dimensions of Interest-Free Banking for a Future-Ready Society

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The contemporary global financial system faces persistent challenges of economic inequality, wealth concentration, financial instability, and limited access to equitable financial opportunities. In this context, interest-free banking, grounded in Shariah principles, offers an ethical and participatory framework for developing just, inclusive, and resilient financial systems. This study analytically examines the application and dimensions of interest-free banking, with particular emphasis on its contribution to a future-ready society. It explores the jurisprudential foundations of Riba, including Riba al-Fadl and Riba al-Nasi'ah, and distinguishes prohibited interest from legitimate profit (Ribh). The study further examines the principle of linking financial transactions with genuine economic activity, asset ownership, and risk-sharing. Major Shariah-compliant modes of financing, including Mudarabah, Musharakah, Murabahah, Tawliyah, and Sukuk, are analyzed in relation to their practical application and contribution to contemporary financial development. The study also highlights major challenges, including dependence on debt-based and fixed-return structures, concerns regarding resemblance to conventional banking, regulatory constraints, and Shariah-governance issues. Drawing on relevant literature and industry insights, including evidence from the State Bank of Pakistan, the study argues that the future development of Islamic banking requires greater emphasis on genuine profit-and-loss sharing, financial inclusion, SME financing, and ethical investment. Furthermore, integrating Islamic banking with FinTech, blockchain, and digital banking can enhance transparency, accessibility, and efficiency. The study concludes that implemented interest-free banking can promote economic justice, financial resilience, responsible innovation, and contribute to building an ethical and future-ready society.

Keywords: Interest-free banking, Islamic finance, Profit and loss sharing, FinTech, Financial inclusion, Future-ready societies

Arabic Language and Literature in the Age of AI: An Islamic Perspective on Future-Ready Societies

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Artificial Intelligence (AI) is rapidly changing the ways Arabic is being taught, translated, created, analyzed, and stored, and is also affecting the production and reception of Arabic literature. The advances in these developments provide great opportunities in relation to the wider dissemination of Arabic heritage, language study, digital archiving and cross-cultural communication. They also have ethical and cultural issues to consider about the linguistic authenticity, authorial intention, plagiarism, misinformation, loss of rhetorical depth, and the neglect of the classical literary and Islamic scholarly traditions. This conceptual study investigates, in an Islamic context, the potential of the Arabic language and literature in the era of artificial intelligence, and seeks to ask: What are the ethical principles of Islam and how do they shape technological innovation towards future-ready societies? The study draws from the Qur'an, Prophetic tradition, Arabic literary tradition, and a consideration of the Maqasid al-Shariah, including the concepts of Human Dignity, Trust, Public Benefit, and the avoidance of harm. It believes that AI is a tool to save and augment Arabic language and literature, not to supplant the creative, moral, and spiritual works of humans. Special focus is placed on the study of Qur'anic Arabic, rhetoric, adab, poetry, and literary criticism as means of identity, morality, and civilizational . The study finds that the development of AI technology and the teaching of Arabic literature in school should be harmonized with Islamic ethics in order to achieve the following objectives: Promoting responsible innovation, maintaining cultural continuity, inclusive education, and morally equipped societies for a future-oriented vision.

Keywords: Arabic language, Arabic literature, Artificial intelligence, Islamic ethics, Maqasid al-Shariah, Future-ready societies

Environmental Rights and Future-Ready Societies: An Islamic Perspective

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Environmental challenges have become one of the most important concerns for present and future societies. Climate change, water scarcity, air pollution, loss of biodiversity and the excessive use of natural resources directly affect human dignity, health, security and quality of life. These challenges raise an important question: how can societies protect environmental rights while preparing responsibly for the needs of future generations? This paper explores this question from an Islamic perspective by examining the ethical principles of the Qur'an and Sunnah related to environmental responsibility, justice and human welfare. Islam presents the natural world as a valuable creation of Allah and emphasizes balance, moderation and responsible use of resources. The Islamic concepts of Khilafah, Amanah (trust), justice, Mizan and avoidance of Israf (wastefulness) provide an ethical foundation for environmental protection. These principles encourage human beings to use natural resources responsibly rather than treating them as unlimited possessions. The paper further examines environmental rights as connected with the broader objectives of Islamic law particularly the protection of life, health, property and human dignity. The study focuses on intergenerational environmental justice, emphasizing the moral responsibility to preserve natural resources for future generations. It argues that Islamic environmental ethics can contribute to sustainable, resilient and socially just future-ready societies through environmental education, sustainable lifestyles, responsible consumption, climate awareness and community-based environmental initiatives. The study concludes that an Islamic perspective on environmental rights is not limited to environmental protection; it offers a comprehensive ethical vision for building societies that respect nature, protect human dignity, promote justice and fulfill their responsibility toward future generations. This perspective can contribute meaningfully to contemporary discussions on sustainability and the future of humanity.

Keywords: Environmental rights, Islamic ethics, Environmental justice, Sustainability, Intergenerational justice

Suffah, Shura, and Seeking Knowledge: A Seerah-Inspired STEAM Education Model for Lifelong Innovation

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In today's rapidly changing world, education is facing the challenge of preparing learners not only with technical skills but also with creativity, ethical awareness, collaboration, and the ability to solve complex problems. This paper presents a Seerah-inspired STEAM education model by exploring three important principles of the Prophetic educational tradition: Suffah, Shura, and seeking knowledge. The institution of Suffah in Madinah provides a remarkable example of a learning community where education was connected with personal growth, mentorship, character building, and social responsibility. The principle of Shura highlights the importance of dialogue, cooperation, critical thinking, and collective wisdom in the learning process. Likewise, the Prophetic encouragement of seeking knowledge reflects a vision of lifelong learning, intellectual curiosity, and continuous improvement. This study aims to develop a conceptual framework that connects these Seerah-based principles with contemporary STEAM education. Through qualitative analysis of Seerah literature, Islamic educational thought, and modern educational approaches, the research examines how traditional wisdom can contribute to innovative learning environments. The proposed model integrates scientific inquiry, technological creativity, ethical reflection, and collaborative learning to develop individuals who can contribute positively to society. The study argues that the integration of Suffah as a knowledge-centered community, Shura as a collaborative learning method, and seeking knowledge as a lifelong educational mission can offer valuable insights for modern education systems. This approach provides a balanced model that combines intellectual development with moral responsibility and prepares learners for meaningful innovation in the contemporary world.

Keywords: Suffah, Shura, Seerah education, Steam education, Islamic pedagogy

Learning and Utilizing Artificial Intelligence Tools for the Development of Islamic Society in the Modern Age

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The rapid advancement of Artificial Intelligence (AI) has transformed the ways in which knowledge is produced, accessed, communicated, and applied across contemporary society. AI tools are increasingly influencing education, academic research, healthcare, business, media, communication, and institutional development, creating both opportunities and challenges for Muslim societies. This qualitative study examines the significance of learning and utilizing AI tools for the intellectual, educational, social, and institutional development of Islamic society in the modern age. Drawing upon the Quran, Prophetic teachings, Islamic intellectual tradition, and the principles of Maqasid al-Shariah, the study explores how AI literacy can be developed within an ethical framework that promotes beneficial knowledge, human dignity, justice, trust, responsibility, and the prevention of harm. Particular attention is given to the potential of AI tools to enhance Islamic education, facilitate scholarly research, support the preservation and dissemination of Islamic heritage, improve communication, and expand access to knowledge. The study also addresses important challenges, including misinformation, dependency on automated systems, privacy concerns, academic integrity, algorithmic bias, and the possibility of using AI for purposes contrary to Islamic ethical values. The study argues that Muslim societies should move beyond passive consumption of emerging technologies toward informed, critical, and responsible engagement with AI. Developing AI literacy among students, educators, researchers, religious scholars, and community institutions can enable them to benefit from technological innovation while maintaining ethical and intellectual principles. The study concludes that the responsible learning and utilization of AI tools can contribute to a knowledgeable, innovative, ethically conscious, and future-ready Islamic society, provided that technological advancement remains aligned with human welfare, moral responsibility, and the broader objectives of Islamic teachings.

Keywords: Artificial intelligence, Islamic society, Digital transformation, , Maqasid al-Shariah, Future-ready society

Artificial Intelligence, Intelligent Pedagogical Processes, and Digital Transformation: Pathways Toward Future-Ready Education

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In the contemporary era of rapid technological convergence, traditional educational frameworks face unprecedented challenges in addressing the dynamic cognitive and skills requirements of 21st-century learners. Aligning with the vision of fostering future-ready societies, the intersection of digital transformation and artificial intelligence (AI) is orchestrating a fundamental paradigm shift across modern instructional domains. This study investigates the multi-faceted impact of adaptive AI tools, intelligent pedagogical frameworks, and broader digital infrastructures on student engagement and academic efficacy within STEAM (Science, Technology, Engineering, Arts, and Mathematics) learning environments. Utilizing a mixed-method approach—combining descriptive-analytical synthesis with quantitative evaluation of empirical data, international educational benchmark reports, and performance metrics from digital learning platforms—this paper systematically measures the outcomes of AI-enabled instruction. The empirical findings reveal that the targeted integration of AI-driven adaptive systems, real-time diagnostic assessments, and automated feedback mechanisms significantly enhances student comprehension, retention, and problem-solving capacities. Furthermore, the analysis indicates that institutional digital transformation optimizes instructional delivery by empowering educators with data-driven pedagogical insights and reducing administrative load. However, the study also highlights critical gaps concerning algorithmic equity, digital infrastructure disparities, and the necessity for continuous faculty development. The paper concludes with actionable strategic and policy frameworks designed to guide educational leaders and policy-makers in navigating digital transformation, thereby ensuring equitable, sustainable, and future-ready STEAM education ecosystems.

Keywords: Intelligent pedagogy, Digital transformation, Adaptive learning, Educational policy, Future-ready skills

Islamic Teachings and the Future of Artificial Intelligence: Ethical Foundations for Future-Ready Societies

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The rapid advancement of Artificial Intelligence (AI) is transforming education, healthcare, scientific research, communication, economics, governance, and other dimensions of contemporary life. While these developments offer significant opportunities for human progress, they also generate complex ethical concerns related to human dignity, privacy, justice, accountability, autonomy, misinformation, and the responsible use of technology. This qualitative study explores the future of Artificial Intelligence through the ethical foundations provided by Islamic teachings and examines their relevance to the development of future-ready societies. Drawing upon the Quran, Prophetic teachings, Islamic jurisprudence, and the objectives of Maqasid al-Shariah, the study identifies key principles that can guide the responsible development and application of AI. Particular attention is given to justice (adl), human dignity (karamah), trust (amanah), public benefit (maslahah), prevention of harm (darar), accountability, and the responsible pursuit of knowledge. The study argues that Islamic teachings encourage beneficial knowledge and scientific advancement while establishing ethical boundaries to ensure that technological innovation remains directed toward human welfare and social justice. It further examines emerging challenges associated with AI, including algorithmic bias, privacy violations, technological inequality, manipulation of information, and excessive dependence on automated systems. The findings suggest that integrating Islamic ethical principles into contemporary AI discourse can contribute to a human-centred and socially responsible approach to technological innovation. The study concludes that genuinely future-ready societies require more than technological capability; they require an ethical foundation that protects human dignity, promotes justice, prevents harm, and directs innovation toward the common good. Islamic teachings can therefore offer a valuable ethical perspective for shaping a responsible, inclusive, and human-centred future of Artificial Intelligence.

Keywords: Artificial intelligence, Islamic teachings, Islamic ethics, Responsible innovation, Ethical Governance, Digital ethics

Revitalizing Ijtihad: An Islamic Approach to Technological and Social Transformation for a Future-Ready Society

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The contemporary world is witnessing rapid technological and social transformation through artificial intelligence, digitalization, biotechnology, globalization, and changing patterns of human interaction. These developments have created complex ethical, legal, social, and intellectual questions for Muslim societies, requiring thoughtful responses grounded in Islamic principles while remaining sensitive to contemporary realities. In this context, revitalizing Ijtihad can provide an important framework for addressing emerging challenges and enabling Islamic thought to engage constructively with a changing world. This paper explores the contemporary relevance of Ijtihad in responding to technological and social transformation and examines its potential contribution to developing an adaptable, ethically responsible, and future-ready Muslim society. Using a qualitative and analytical approach, the study draws upon the Qur'an, Sunnah, classical Islamic jurisprudence, and contemporary scholarship on Ijtihad, Islamic intellectual renewal, and Maqasid al-Sharia. Particular attention is given to emerging issues related to artificial intelligence, digital ethics, biotechnology, education, employment, social relationships, and changing societal structures. The study argues that revitalizing Ijtihad does not mean abandoning established Islamic principles; rather, it involves their informed application through contextual understanding, interdisciplinary knowledge, collective scholarly reasoning, and consideration of contemporary circumstances. A dynamic approach to Ijtihad can bridge Islamic intellectual heritage with modern technological realities while safeguarding human dignity, justice, morality, and social responsibility. The paper concludes that revitalized Ijtihad can empower Muslim societies to engage confidently with innovation and transformation while maintaining their religious and ethical foundations.

Keywords: Ijtihad, Islamic intellectual renewal, Technological transformation, Maqasid al-Shariah,

Intellectual and Spiritual Nurturing of Youth for Future-Ready Societies: A Study in Light of the Seerah in the Postmodern Era

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The education given to young people influences the kind of public life they will later shape. Young people today face competing ideas about truth, changing moral expectations, and identity pressures associated with postmodern culture. The Seerah of the Prophet Muhammad ﷺ presents education as a process that develops judgment, faith, service, and responsibility together. This study examines that process through a qualitative and analytical reading of classical Seerah sources. The Prophet ﷺ gave young companions meaningful opportunities to learn and serve. Mus'ab ibn 'Umayr, 'Ali ibn Abi Talib, and Usamah ibn Zayd (may Allah be pleased with them) were entrusted with diplomatic, educational, and civic responsibilities because their preparation suited them for demanding roles. Their examples show that youth development cannot be reduced to technical instruction or examination success. Young people also need patient conversation, moral direction, practical experience, and a sense of responsibility toward others. Families, schools, and community organizations can draw on these features when developing mentoring programmes. Young people should be encouraged to examine ideas carefully, face emotional pressure with support, and take part in work that benefits the community. Intellectual discipline joined with spiritual grounding can prepare them for responsible participation in peaceful and future-ready societies.

Keywords: Youth mentorship, Seerah, Character building, Postmodernism

Between Sign and Silence: Language Barriers to Religious Learning Concepts Among Deaf for Future-Ready Societies

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In Islam pursuing knowledge is an essential duty for all Muslims, including Deaf people however their ability to access religious teachings can be restricted due to the strong dependence on verbal explanations, recitations and specialized language in religious education. This research sought to determine the linguistic obstacles that Deaf people encounter in understanding Islamic religious concepts. A descriptive survey design using a quantitative approach was utilized. Data were gathered using a self-created 24-item questionnaire based on a five-point Likert scale from 70 Deaf participants (74.3% male, 25.7% female) from different locations chosen via convenience sampling. The tool demonstrated satisfactory reliability (Cronbach's α .79) and the data were analyzed descriptively through SPSS. Average ratings for all items ranged from moderate to high levels of perceived language obstacles. Participants indicated that religious educators and Imams struggle to communicate effectively with Deaf students (M 3.68) and noted the absence of a standardized sign language for Islamic concepts (M 3.62). The research finds that the lack of qualified interpreters and instructors, the lack of uniform religious signs and challenges with Arabic vocabulary are the primary obstacles to Deaf people's religious education. A standardized vocabulary for religious signs, accessible educational programs for Deaf students and interpreters along with teachers trained in Islamic terms are essential for providing fair access to Islamic knowledge and fostering inclusive future-ready communities. These initial results suggest that a uniform religious sign language vocabulary, accessible educational programs for Deaf students, and instructors knowledgeable in Islamic terms are essential for providing fair access to Islamic education and fostering an inclusive future-oriented community.

Keywords: Deaf community, Language barriers, Sign language, Religious education, Inclusive education

The Islamic Concept for a Future-Ready Society: An Analytical Study of Faith, Knowledge, Technology, and Human Well-Being

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The skills that are necessary for future ready individuals and societies are being transformed by rapid developments in Artificial Intelligence, technology, and science. However, many modern conceptions of future-readiness focus on skills, creativity and technological flexibility rather than meaning, thriving, or ethical agency. While sustainability and related social issues are addressed in international frameworks to an increasing extent, aspects of purpose, values and ethical responsibility are less well theorized, especially from Islamic perspectives. In response to this, this study seeks to fill this gap through a theoretical model of Islamic future readiness which integrates the four dimensions: knowledge, technology, faith and human well-being. Selected verses from the Quran and Prophetic traditions, as well as classical and contemporary Islamic scholarship and relevant global paradigms on future readiness, sustainability and education are examined systematically. Qualitative thematic analysis is used to examine the conceptual associations between the dimensions and how they relate to future-ready societies. The results indicate that the future readiness of Islam is not only technical skills and competencies but also a combination of knowledge obtained from revelation and reason, technology in the form of a trust to be directed towards the benefit of humans, and human well-being based on the principles of Maqasid-al-Shariah. Wasatiyyah (balance) is an integrative principle which links these dimensions. The research also specifies some problems such as digital divide, materialism, lack of research capacity, and insufficient ethical orientation in science and technology education. The proposed framework helps add a dimension of purpose and ethical responsibility to the conversation about future readiness and provides a conceptual starting point for additional research and policy development.

Keywords: Islamic future readiness, Faith, Knowledge, Human well-being

Green Sukuk and Waqf as Islamic Instruments for Climate Finance: A Framework for Future-Ready Societies

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Climate change has emerged as the most pressing challenge for future-ready societies, with Pakistan ranking among the top ten most climate-vulnerable countries despite contributing less than 1% to global emissions. The recent floods of 2022-2024, severe heatwaves, and water scarcity have exposed the inadequacy of conventional finance to address climate resilience. This study explores innovative Islamic finance instruments "Green Sukuk and Waqf" as sustainable, ethical, and Shariah-compliant solutions for climate finance. The primary objective is to propose an integrated Green Sukuk-Waqf model that can fund renewable energy, reforestation, clean water, and climate-resilient agriculture projects in Pakistan. The research adopts a qualitative and analytical approach, drawing on Quranic principles of stewardship (Khilafah) and trust (Amanah), Sunnah teachings on environmental conservation, contemporary Maqasid al-Shariah literature, and case studies of successful Green Sukuk issuances in Malaysia, Indonesia, and the Islamic Development Bank (IsDB). Findings reveal that Green Sukuk provides a capital market mechanism for large-scale green projects, while Waqf offers a perpetual, community-based social finance model for localized climate adaptation. Malaysia's issuance of over $1.5 billion in Green Sukuk for solar projects and Indonesia's Waqf-linked solar initiatives demonstrate the practical viability of this model. Unlike interest-based climate finance, this Islamic model ensures risk-sharing, ethical investment, and social justice, aligning with UN Sustainable Development Goals (SDGs) 13, 7, and 15. The study concludes that integrating Green Sukuk and Cash Waqf, supported by fintech and blockchain for transparency, can create a robust climate finance ecosystem for Pakistan. It recommends policy reforms by the State Bank of Pakistan, Securities and Exchange Commission, and Ministry of Climate Change to institutionalize this hybrid model, positioning Islamic finance as a leading force for building climate-resilient, future-ready societies.

Keywords: Green sukuk, Waqf, Climate finance, Islamic sustainable finance

Islamic Finance and Economic Models for Future-Ready Societies

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The emergence of future-ready societies is closely associated with economic resilience, financial inclusion, technological innovation, sustainability, and equitable access to economic opportunities. In an era of digital transformation, artificial intelligence, FinTech, globalization, and growing economic inequalities, conventional economic models face challenges in ensuring inclusive and ethically sustainable development. Islamic finance, grounded in the principles of the Qur'an and Sunnah, provides an ethical framework centered on justice, social responsibility, risk-sharing, and human well-being. This paper explores how Islamic finance and Islamic economic principles can contribute to the development of future-ready societies. It examines key principles including the prohibition of ribā, gharar, and maysir, risk-sharing, ethical investment, zakāh, waqf, and social welfare, highlighting their relevance to contemporary economic challenges. The study investigates the potential of Islamic financial instruments to promote financial inclusion, entrepreneurship, poverty reduction, sustainable development, and equitable wealth distribution. It also discusses opportunities and challenges arising from the integration of Islamic finance with modern technologies, including digital banking, FinTech, blockchain, artificial intelligence, and digital payment systems. The study adopts a qualitative and analytical approach, drawing upon Qur'anic principles, Prophetic teachings, classical Islamic economic thought, and contemporary scholarship. It argues that technological innovation, guided by Islamic ethical principles, can enhance transparency, accessibility, efficiency, and accountability in financial systems. The study concludes that integrating Islamic economic values with responsible technological innovation can support economically resilient, inclusive, ethical, and sustainable societies while aligning economic progress with justice, human dignity, social welfare, and the broader objectives of Maqāṣid al-Sharīʿah.

Keywords: Islamic finance, Islamic economics, Maqāṣid al-Sharīʿah, Financial inclusion, FinTech, Sustainable development, Social justice

Can AI Issue a Fatwa? Procedural Ethics of Judgment for Future-Ready Societies

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Generative artificial intelligence has transformed access to Islamic knowledge by producing fluent, personalized answers that increasingly resemble religious judgments. This development raises a question that concerns not merely technical accuracy but religious authority: can AI legitimately issue a fatwa? This article develops a conceptual-normative answer through a critical reconstruction of Ibn Taymiyya's procedural ethics of individualized judgment. It examines his distinction between general doctrinal classification and its application to a determinate person, the requirements of establishing proof and removing ambiguity, the assessment of epistemic access, authentication, comprehension, interpretation, and culpability, as well as the fulfillment of conditions and absence of impediments. *Takfīr* is employed as a bounded stress test rather than a model for every fatwa: if the most consequential judgment of religious status cannot be inferred automatically from a statement or action, personalized high-stakes fatwas cannot be delegated to probabilistic text generation. The analysis finds that current AI systems may assist source retrieval, translation, comparison of opinions, case organization, and preliminary drafting, but cannot independently issue a fatwa. Fatwa issuance requires contextual and dialogical inquiry, responsible application of general norms to particular circumstances, and an identifiable authority capable of bearing moral, scholarly, and institutional accountability. The article therefore proposes a fourlayer framework—retrieval, deliberation, human ratification, and accountability— supported by differentiated risk levels for AI deployment. It concludes that futureready Muslim societies should adopt AI-assisted Islamic scholarship without allowing AI to replace religious authority. Technological efficiency must remain subordinate to procedural integrity, qualified human judgment, and accountable institutional oversight.

Keywords: Artificial intelligence, Fatwa, Ibn Taymiyya, Procedural ethics, Religious authority

Between Amānah and Algorithm: Artificial Intelligence in Qur'anic Education and a Qur'an-Informed Framework for Future-Ready Learning

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The oldest surviving system of religious education in the Muslim world is the Qur'anic education. It reaches hundreds of millions of learners in schools, madrasas, mosques, homes and increasingly via digital platforms. Artificial Intelligence (AI) is now entering this realm in the shape of recitation-assessment tools, chatbots, adaptive memorization applications and generative systems that explain, translate and interpret the Qur'anic text. These technologies promise greater access and tailored support, but they also touch a text whose integrity, authority and moral purpose are sacred. The literature about AI in education is largely secular and rarely engages the epistemology of revelation. This article explores the ethical challenges and prospects of AI in Qur'anic education and provides a Qur'anic-based framework for institutions, teachers, developers and policymakers to responsibly adopt AI. The study is designed in a qualitative conceptual-analytical design. It employs (a) thematic analysis of Qur'anic and Prophetic discourse on knowledge (ʿilm), trust (Amānah), verification (Tabayyun), purification (Tazkiyah) and justice (ʿadl); (b) purposive review of AI-in-education and AI-ethics scholarship; and (c) Maqāṣid-based synthesis to derive design principles. No new empirical data were collected. AI offers real value in five areas: adaptive pacing, recitation feedback, linguistic and textual access, inclusion and teacher support. It also carries six major risks: textual corruption through "hallucination, " usurpation of interpretive authority, algorithmic bias, privacy violations, erosion of the teacher–student relationship (*talaqqī*) and inequitable access. The analysis yields a five-pillar framework (Authentic Source, Verified Knowledge, Accountable Trust, Character and Presence, and Just Mercy) that treats AI strictly as an assistive instrument under human, scholarly authority. The framework gives institutions a basis for policy, gives developers design requirements (source-locking, scholarly review, transparency, data minimization) and gives teachers a role-clarified model of "human-in-the-loop" pedagogy. It also offers a transferable approach for value-based AI governance in faith-based education generally.

Keywords: Artificial intelligence, Qur'anic education, Islamic ethics, Maqāṣid al-Sharīʿah

Urdu Literary Ethics: Shaping Future-Ready Muslim Societies Through Islamic Values

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Within the STEAM framework, the arts and literature are essential for nurturing not only creativity and critical thinking but also moral character. Urdu literature, shaped over centuries by Islamic thought, Sufi tradition, and reformist movements, holds a rich ethical heritage that remains underexplored in discussions of future-oriented education. This paper examines how Urdu literary ethics, understood as the moral values, ideals, and responsibilities expressed in Urdu poetry and prose, can contribute to building future-ready Muslim societies grounded in Islamic values. Using a qualitative, analytical approach, the study explores ethical themes in selected works of Urdu literature, including justice, honesty, trust, compassion, tolerance, humility, and social responsibility. These themes are examined in light of Qur'anic teachings and the Prophetic tradition, with attention to how literature has historically served as a vehicle for moral reform and cultural identity. The paper further considers how these values can be integrated into modern curricula and applied to contemporary challenges such as digital ethics, misinformation, and the responsible use of technology. The study argues that Urdu literary ethics offers a culturally grounded and spiritually meaningful framework for balancing technological progress with moral responsibility. It recommends incorporating ethically oriented Urdu texts into STEAM-based curricula, promoting interdisciplinary collaboration between literature, Islamic studies, and technology, and using digital platforms to make this literary and moral heritage accessible to younger generations.

Keywords: Urdu literary ethics, Islamic values, Muslim societies, STEAM education, moral education, digital ethics

From Hijrah to Hudaibiyah: Sirah as a Framework for Crisis Management, Migration, and Peace Engineering

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This study examines the Prophetic experience from the Hijrah to Madinah through the Treaty of Hudaibiya, as a coherent framework for crisis management, migration governance, conflict transformation, and peacebuilding. Rather than treating the Hijrah and Hudaibiya as isolated episodes of sacred history, the article reads them as successive stages in the construction of a resilient moral and political community. The analysis is grounded primarily in the Qur'an and Sunnah, supplemented by early *Sīrah* and historical sources and by selected modern scholarship on conflict transformation and peacebuilding. The article argues that the Prophetic method combined spiritual conviction with disciplined risk assessment, information management, strategic relocation, social integration, institutional legitimacy, consultation, proportionality, negotiated restraint, and long-term thinking. The Hijrah demonstrates that migration can be an organized response to existential insecurity rather than an act of uncontrolled departure. The Prophet ﷺ selected a destination, established a social base, planned logistics, protected information, cultivated alliances, and converted displacement into institution-building. The Madinan period further demonstrates that social cohesion, constitutional arrangements, fraternity between Muhājirin and Anṣār, and responsible citizenship were essential to crisis resilience. At Hudaibiyah, the Prophet ﷺ transformed an apparent tactical setback into a strategic opening by defining the objective narrowly, preventing escalation, maintaining disciplined communication, and preserving the possibility of future cooperation. The article concludes with a proposed "Prophetic Crisis-to-Peace Framework" consisting of twelve interconnected principles: moral purpose, diagnosis, consultation, strategic patience, lawful means, information discipline, protective migration, social integration, institutional legitimacy, negotiated de-escalation, proportionality, and post-crisis reconciliation. The framework is presented as an Islamic ethical and historical model rather than as a claim that seventh-century events can simply be copied into modern contexts.

Keywords: Sīrah, Hijrah, Hudaibiyah, Crisis management, Migration, Peacebuilding, conflict resolution, Islamic political ethics

Urdu Language and Literature in the Age of AI: An Islamic Perspective on Future-Ready Societies

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The STEAM framework, which integrates science, technology, engineering, arts, and mathematics, places the arts and literature at the heart of future-oriented education. Within this framework, this paper examines how Urdu language and literature can preserve their linguistic identity, creative tradition, and intellectual dignity amid the rapid rise of artificial intelligence, and what role they can play, in light of Islamic teachings, in building future-ready societies. The study analyzes opportunities and challenges for Urdu in machine translation, natural language processing, automated text generation, digital archives, and educational technology. Key challenges include the scarcity of quality digital resources and linguistic datasets, the technical complexities of the Nastaliq script, and the need to protect the uniqueness of human creativity against machine-generated writing. From an Islamic perspective, the paper draws on principles such as the pursuit of knowledge, reflection, trust and integrity, and the use of language as a vehicle for truth, arguing that technology benefits humanity most when employed within ethical boundaries. The study concludes that AI is both a threat and a significant opportunity for Urdu, provided that universities, writers, linguists, and technologists collaborate to expand Urdu's digital resources. It recommends integrating digital literacy into Urdu curricula, prioritizing the development of Urdu datasets and linguistic tools, and using modern technology to preserve and promote literary and religious heritage. In doing so, the integration of Urdu literature and technology can strengthen the STEAM vision within a local and Islamic cultural context.

Keywords: Urdu language & literature, Artificial intelligence, Islamic perspective, Digital literacy

Learning the Tools of Artificial Intelligence for the Growth of Islamic Society in the Modern Age

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The rapid development of Artificial Intelligence (AI) has introduced powerful tools that are increasingly transforming education, research, communication, healthcare, business, media, and social development. For Islamic societies, understanding and effectively utilizing these emerging technologies presents both a significant opportunity and an important responsibility. This qualitative study explores the role of learning and utilizing AI tools in the intellectual, educational, social, and institutional growth of Islamic society in the modern age. Drawing upon the Quran, Prophetic teachings, Islamic intellectual traditions, and the principles of Maqasid al-Shariah, the study examines how AI literacy can contribute to the advancement of knowledge, educational innovation, research capabilities, preservation and dissemination of Islamic scholarship, and constructive engagement with contemporary technological developments. Particular attention is given to the Islamic emphasis on the pursuit of beneficial knowledge, intellectual development, responsible use of resources, verification of information, human dignity, and the prevention of harm. The study argues that AI should neither be viewed merely as a technological challenge nor adopted without critical reflection; rather, Muslim individuals and institutions should acquire the knowledge and skills necessary to use AI tools responsibly, ethically, and productively. The study further highlights the need for digital and AI literacy among students, researchers, educators, religious scholars, and community institutions so that emerging technologies can be employed for educational advancement, scholarly research, social welfare, and the preservation of Islamic intellectual heritage. The findings suggest that responsible mastery of AI tools can strengthen the capacity of Islamic societies to participate meaningfully in the knowledge economy while maintaining their ethical and intellectual values. The study concludes that developing AI literacy within an Islamic ethical framework can contribute to a knowledgeable, innovative, responsible, and future-ready Islamic society.

Keywords: Artificial intelligence, Islamic society, Islamic education, Maqasid al-Shariah, Responsible technology, Knowledge development

Integrating Islamic Ethical Worldview into STEAM Education: A Framework for Developing Future-Ready, Sustainable, and Value-Based Societies

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In the 21st century, the development of future-ready societies is increasingly shaped by advancements in Science, Technology, Engineering, Arts, and Mathematics (STEAM), with emphasis on technical competencies, innovation, and economic competitiveness. While this technocentric approach has accelerated human progress, it can marginalize the ethical, moral, and spiritual dimensions necessary for holistic and sustainable development. Consequently, powerful technologies such as Artificial Intelligence and biotechnology may advance without adequate moral guidance. This study addresses this gap by exploring the integration of the Islamic ethical worldview into STEAM education. It argues that Islamic principles provide a comprehensive ethical foundation for guiding technological development and shaping responsible future societies. Concepts such as Tawhid (unity of knowledge and reality), Khilafah (responsible stewardship of creation), Adl and Ihsan (justice and excellence), Mizan (balance and moderation), and Maslahah (public interest) offer significant guidance for responsible innovation. Employing a qualitative conceptual-analytical methodology, the study draws upon primary Islamic sources, particularly the Qur'an and Sunnah, alongside contemporary literature on STEAM education and emerging technologies. Based on this analysis, the study proposes a value-integrated STEAM framework with three major applications. First, it reframes sustainability and green innovation through Mizan, encouraging ecological balance and responsible resource use. Second, it provides an ethical framework for Artificial Intelligence and educational technologies grounded in human dignity (Karamah), accountability, and responsible decision-making. Third, it promotes equity, inclusion, and social well-being through Islamic principles of justice and compassion. The study concludes that integrating Islamic ethics into STEAM education does not reject modernity; rather, it enriches technological advancement with moral purpose, producing technically competent, ethically conscious, socially responsible, and spiritually grounded individuals capable of contributing to sustainable and value-based future societies.

Keywords: Steam education, Islamic ethics, Tawhidic paradigm, Sustainable innovation, Value-based education, AI ethics

Science, Revelation and Future-Ready Societies: Contemporary Muslim Strategies of Traditionalism, Integration and Critical Analysis

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The taxonomical relationship between scientific inquiry and religious belief has long been a source of tension in both modern and ancient discourse, particularly within the Islamic world. This paper examines how contemporary Muslim scholars navigate this complex relationship, categorizing their approaches into four distinct strategies: conservativism, traditionalism, integration, and critical analysis. Each approach reflects unique epistemological and theological priorities, shaping the broader dialogue between science and faith. *Conservative approaches*, such as the notion of Qur'anic scientific miracles, assert that the Qur'an contains scientific truths revealed centuries before modern discoveries. However, this view often faces criticism for modifying scripture to fit scientific knowledge, risking oversimplification. *Traditionalist strategies* focus on reviving religious meaning without directly engaging scientific paradigms. This approach seeks to preserve faith's primacy, viewing science as secondary to divine wisdom. *Integrative approaches* aim to harmonize scientific theories, such as evolution, with Islamic theology. Scholars propose frameworks where science and faith coexist, interpreting evolutionary processes as divinely guided. This perspective appeals to those seeking a synthesis that respects both domains but may struggle to address conflicts with literalist readings of scripture. *Critical approaches*, highlight incompatibilities between scientific methodologies and religious dogma. These scholars argue that science rely on empirical falsifiability while faith bases in revelation. This stance fosters intellectual honesty but risks separating religious communities. Today, conservative and integrative approaches seem dominate due to their appeal to religious audiences. A pluralistic framework, encouraging open dialogue and mutual respect, may best promote scientific literacy while preserving spiritual integrity. By fostering critical engagement, Islam can navigate modernity without compromising its theological core, enriching both scientific and religious discourse.

Keywords: Islam, Science, Reconciliation, Traditionalism, Integration, Contemporary scholars

Empowering STEM Education Through Islamic Perspective: The USIM Approach

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STEM education plays an important role in preparing learners to navigate a rapidly changing world shaped by technological advancement, artificial intelligence, healthcare innovation and emerging societal challenges. However, STEM education should not only focus on technical competencies and scientific knowledge; it should also nurture ethical awareness, responsibility, values and a sense of purpose in applying knowledge for the benefit of humanity. As an Islamic university, Universiti Sains Islam Malaysia (USIM) adopts an integrated approach that brings together Naqli and Aqli knowledge in teaching, learning, research and innovation. This sharing session presents the USIM approach to empowering STEM education through the integration of scientific and technological knowledge with Islamic perspectives, values and ethical considerations. The session will highlight practical examples of how the integration can be translated into STEM modules, group activities, hands-on and kit developments. Ultimately, the USIM approach aims to develop students who are not only technically competent and innovative, but also ethically grounded, socially responsible and able to use knowledge and technology towards meaningful human and societal development

Keywords: Empowering, Innovation, STEM education, USIM approach

Women's Emotional Intelligence and Family Stability: An Interdisciplinary Study in the Light of The Qur'an and Sunnah Within Contemporary Psychological and Social Perspectives

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Emotional intelligence plays a significant role in shaping interpersonal relationships, emotional well-being, and family stability. In contemporary societies, changing family structures, emotional pressures, and evolving marital expectations have increased the need to understand the emotional dimensions of family life. This interdisciplinary study examines the role of women's emotional intelligence in promoting family stability in the light of the Qur'an and Sunnah, while engaging with contemporary psychological and sociological perspectives. The study focuses on key dimensions of emotional intelligence, including emotional awareness, self-regulation, empathy, effective communication, and responsible decision-making, and explores their relevance to marital relationships, conflict resolution, mutual understanding, and the emotional well-being of family members. Islamic teachings provide a comprehensive ethical and spiritual framework emphasizing compassion, patience, forgiveness, mutual respect, emotional balance, and responsible family conduct. Qur'anic principles and Prophetic guidance are examined alongside contemporary theories of emotional intelligence and family functioning to identify areas of convergence and complementary insights. The study argues that women's emotional intelligence can contribute significantly to creating a harmonious and emotionally secure family environment by promoting constructive communication, reducing interpersonal tensions, managing conflicts effectively, and strengthening marital relationships. However, family stability is recognized as a shared responsibility between spouses. By integrating Islamic guidance with contemporary psychological and sociological insights, the study proposes a balanced framework for understanding emotional competence as a means of strengthening family relationships. It concludes that combining Qur'anic and Prophetic principles with modern approaches to emotional intelligence can provide a culturally relevant and ethically grounded framework for promoting sustainable family stability, emotional well-being, and healthy interpersonal relationships in the modern context.

Keywords: Women, Family stability, Qur'an and Sunnah, Family relationships, Emotional well-being

Ethical Boundaries of Artificial Intelligence for Future-Ready Societies: An Analytical Study from an Islamic Perspective

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The transformative proliferation of Artificial Intelligence (AI), automated decision systems, and algorithmic intelligence in the 21st century has redefined contemporary societal structures, educational ecosystems, and global governance. While AI promises substantial socio-economic innovation and pedagogical acceleration toward building future-ready societies, it simultaneously introduces pressing ethical crises. These include algorithmic bias, systemic surveillance, intellectual deskilling, digital inequities, and challenges to human dignity and moral autonomy. This study provides an analytical and normative inquiry into establishing the ethical parameters of AI deployment, examining these emerging technologies through the lens of Islamic intellectual and legal thought. Methodologically, this research adopts a qualitative, analytical-deductive, and comparative approach. It integrates textual exegesis (*Dirāyah*) of foundational Islamic sources with contemporary technological and ethical discourses. The inquiry is grounded in the foundational paradigm of *Maqāṣid al-Sharī'ah* (the Higher Objectives of Islamic Law), systematically evaluating how core universal imperatives, specifically the preservation of intellect (*ḥifẓ al-'aql*), human life and dignity (*ḥifẓ al-nafs*), property (*ḥifẓ al-māl*), and public interest (*maṣlaḥah mursalah*), can serve as ethical boundaries for algorithm design, data management, and machine intelligence. The paper further interrogates the application of value-driven ethics within next-generation educational technologies and STEAM curricula, arguing that technological literacy must be tethered to human viceregency (*Khilāfah*) and ethical accountability (*Amānah*). The findings demonstrate that Islamic ethical theory provides a robust, human-centered framework capable of mitigating algorithmic harms while harnessing AI's constructive capabilities. Ultimately, the study presents an operational ethical framework for educators, engineers, and policymakers, ensuring that technological progress remains subordinated to social justice, moral equity, and the collective well-being of future societies.

Keywords: Algorithmic justice, Artificial intelligence, Ethical frameworks, Islamic epistemology, STEAM education.

Beyond Smart Societies: An Islamic Ethical Framework for Building a Future-Ready Civilization

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Rapid technological change, ecological instability, and widening social inequality demand a vision of progress that is innovative, ethical, inclusive, and human-centred. This paper explores how the Islamic worldview can contribute to building future-ready societies through the integrated principles of Maqāṣid al-Sharīʿah, khilāfah (responsible stewardship), amānah (moral responsibility), ʻadl (justice), and iḥsān (excellence). It argues that technological advancement cannot be regarded as genuine progress unless it protects human dignity, strengthens collective well-being, preserves the environment, and serves the common good. Using a qualitative and conceptual approach, the study relates Islamic ethical principles to contemporary challenges involving artificial intelligence, digital transformation, education, environmental sustainability, social inequality, and inclusive governance. The analysis proposes a values-based framework in which scientific knowledge and technological innovation are guided by moral accountability, equitable access, responsible decision-making, and concern for future generations. Within this framework, technology is viewed as a means of serving humanity rather than an end in itself. Education plays a central role in nurturing individuals who are spiritually grounded, intellectually capable, digitally proficient, ethically aware, and socially responsible. The study further highlights the importance of balancing individual development with collective welfare and technological innovation with environmental and social responsibility. It argues that the Islamic intellectual heritage does not inherently resist modernization; rather, it provides ethical principles through which innovation can be directed toward balanced, inclusive, and sustainable progress. By integrating faith, reason, knowledge, innovation, and accountability, Muslim communities can respond constructively to contemporary challenges and contribute to global advancement while preserving their ethical identity. The paper concludes that an Islamic values-based approach can support the development of resilient, sustainable, and human-centred future-ready societies committed to the welfare of humanity.

Keywords: Islamic ethics, Artificial intelligence, Sustainable development, Human-Centred innovation, Social responsibility

Future-Ready Islamic Humanities: Balancing Technological Innovation and Religious Sanctity in VR-Based Seerah Classrooms

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As digital technologies reshape modern pedagogy, the integration of Virtual Reality (VR) into religious education offers transformative opportunities for immersive and experiential historical learning. This paper explores how VR and spatial computing can enhance Seerah (Prophetic biography) classrooms by transforming traditional, textbook-based instruction into interactive, geography-centered learning environments. Through carefully developed three-dimensional reconstructions of seventh-century Arabian landscapes, trade routes, settlements, and architectural spaces, students can develop a deeper and more context-aware understanding of the historical, geographical, and social dimensions of Seerah. Such immersive environments may strengthen spatial memory, historical awareness, student engagement, and meaningful learning experiences. However, introducing extended reality (XR) technologies into sacred history requires careful ethical and theological consideration. This study proposes a balanced design framework that reconciles emerging educational technologies with Islamic ethical principles and the sanctity of Prophetic history. Particular attention is given to the prohibition of visual representation of the Prophet Muhammad ﷺ and the Companions. Accordingly, the proposed framework shifts the focus from human representation toward environmental reconstruction, spatial orientation, historical mapping, ambient soundscapes, textual narration, and non-pictorial storytelling mechanisms. Through qualitative review and pedagogical analysis, the study examines how such an approach can utilize the educational potential of VR while maintaining religious sensitivity and theological integrity. The paper argues that responsible VR design can create immersive learning experiences without compromising the sacred character of Seerah. Ultimately, the study offers educators, instructional designers, and Islamic scholars a sustainable framework for developing future-ready Islamic humanities curricula that harmonize technological innovation, pedagogical effectiveness, and religious sanctity while preparing learners to engage critically and responsibly with emerging digital environments.

Keywords: Educational VR, Seerah pedagogy, Digital humanities, Islamic EdTech, Virtual reality ethics, Spatial computing, Islamic education.

The Qur'anic Vision for Future-Ready Societies: Balancing Artificial Intelligence, Human Intelligence, and Ethical Responsibility

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The rapid advancement of artificial intelligence is reshaping the ways in which knowledge is produced, accessed, evaluated, and applied. As AI becomes increasingly integrated into education, science, technology, engineering, the arts, and mathematics (STEAM), the central challenge is no longer merely how intelligently machines can process information, but how responsibly human beings can exercise judgment, agency, and moral responsibility in an increasingly AI-mediated world. This keynote proposes a Qur'anic perspective on this emerging challenge and explores its implications for the formation of genuinely future-ready societies.The Qur'an approaches knowledge not as an end in itself, but as a trust associated with purpose, discernment, and responsibility. The opening revelation, ﴿اقْرَأْ بِاسْمِ رَبِّكَ الَّذِي خَلَقَ﴾, establishes a foundational relationship between knowledge, the Creator, and human responsibility. From this perspective, technological capability does not by itself constitute human advancement. Rather, the value of knowledge and innovation is determined by how they contribute to human flourishing and how responsibly they are employed. Particular attention will be given to the Qur'anic principle of verification and critical discernment, articulated in ﴿فَتَبَيَّنُوا﴾ (Qur'an 49:6), and to the Qur'anic conception of the human being as a responsible agent entrusted with stewardship on earth, expressed in ﴿إِنِّي جَاعِلٌ فِي الْأَرْضِ خَلِيفَةً﴾ (Qur'an 2:30). These principles provide an important ethical framework for engaging with generative AI, where the ability to produce plausible information must be distinguished from the capacity to establish truth, exercise sound judgment, and assume responsibility for consequences. Ultimately, the Qur'anic vision presented in this keynote calls for a future in which technological intelligence is guided by human wisdom, innovation is governed by ethical responsibility, and artificial intelligence remains aligned with human dignity and flourishing. A truly future-ready society, therefore, is not defined simply by the intelligence of its technologies, but by the wisdom, agency, and responsibility of the human beings who develop and employ them.

Keywords: Artificial intelligence, Human intelligence, Qur'anic vision, Ethical responsibility

Islamic Ethical Framework for Emerging Technologies: Challenges and Future Directions in Society

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The rapid emergence of transformative technologies, including Artificial Intelligence, biotechnology, robotics, nanotechnology, and advanced digital systems, is reshaping human life and creating new possibilities for education, healthcare, scientific research, communication, and economic development. At the same time, these developments raise significant ethical concerns related to human dignity, privacy, justice, autonomy, accountability, inequality, and the potential misuse of technology. This qualitative study explores the development of an Islamic ethical framework for emerging technologies and examines its relevance to the challenges and future directions of technological innovation. Drawing upon the Quran, Prophetic teachings, Islamic jurisprudence, and the objectives of Maqasid al-Shariah, the study identifies key ethical principles that can guide the responsible development and application of emerging technologies. Particular attention is given to justice (*adl*), human dignity (*karamah*), public benefit (*maslahah*), prevention of harm (*darar*), trust (*amanah*), accountability, and the protection of life, intellect, wealth, and human welfare. The study argues that Islam encourages beneficial scientific inquiry and technological advancement while emphasizing moral responsibility and the prevention of harm. An Islamic ethical framework can therefore provide normative guidance for balancing innovation with human values and social responsibility. The study further highlights contemporary challenges, including ethical uncertainty surrounding artificial intelligence, genetic technologies, autonomous systems, data privacy, and technological inequality. It proposes that integrating Islamic ethical principles into contemporary science and technology discourse can contribute to a more responsible, inclusive, and human-centred model of innovation. The study concludes that future-ready societies require not merely technological competence but an ethical vision capable of ensuring that emerging technologies remain aligned with human dignity, justice, public welfare, and responsible stewardship.

Keywords: Emerging technologies, Islamic ethics, Maqasid al-Shariah, Artificial intelligence, Human dignity, Ethical governance

ISLAMIC PERSPECTIVE FOR FUTURE READY SOCIETIES

POSTER

PRESENTATIONS

Islamic Family Values and Their Role in Strengthening Future Societies

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The family is one of the fundamental institutions of human society and serves as a vital foundation for the development and continuity of social life. Human societies grow and flourish through the formation and interaction of families. The family plays a central role in the moral, emotional, intellectual, ideological, and social development of individuals. In the contemporary era, environmental changes, rapid technological advancement, changing lifestyles, digital modes of living, increasing social distance in interpersonal relationships and various economic and social challenges have significantly transformed the structure of the family and adversely affected its moral and cultural values. These developments have created serious challenges for the traditional family system and raised important questions about its stability and future. This study explores the Islamic concept of family values and the role of the family in strengthening future societies. It examines family formation, relationships, mutual rights and responsibilities, factors and obstacles and possible solutions in the light of Islamic teachings. Islamic teachings provide a comprehensive family framework based on faith, love, mercy, responsibility, justice, tolerance, respect, cooperation and moral and spiritual development. The study is based on the Qur'an, Hadith and Seerah of the Prophet Muhammad (PBUH). The family life of the Prophet Muhammad (PBUH) is presented as a practical role model for harmonious and morally responsible family relationships. The research examines family conflicts, generational gaps, familial hostility, weakening interpersonal relationships, moral, social deterioration and explores possible solutions through the values and practices of the first three generations of Islam. The study concludes that the proper understanding and implementation of Islamic family values can strengthen family relationships and contribute to a stable, peaceful, tolerant, morally responsible and resilient society capable of responding to future challenges.

Keywords: Islamic family values, Qur'an, Hadith, Moral development, Islamic teachings

Addressing AI Hallucinations in Islamic Research: Developing Fact-Checking Frameworks for Digitized Religious Texts

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This study evaluates the frequency and structural nature of Large Language Model (LLM) hallucinations within Islamic research datasets. It specifically aims to quantify the generation of fabricated textual evidence and propose a hybrid verification framework to protect theological accuracy. We tested three leading commercial generative AI models using a customized benchmark of 500 prompts covering Quranic text, Hadith verification, and Islamic jurisprudence (Fiqh). Responses were evaluated by Islamic studies experts and cross-checked against authoritative digital repositories using string-matching algorithms. The analysis revealed a 34% hallucination rate across the tested models, predominantly manifesting as fabricated primary source citations and seamlessly generated but historically nonexistent chains of transmission (*Isnad*). The models consistently prioritized linguistic fluency over strict factual authenticity. The study concludes that standard LLMs present high epistemic risks for sensitive religious research without specialized guardrails. We recommend a hybrid retrieval-augmented generation (RAG) framework that restricts model outputs to verified, domain-specific academic databases, bridging the gap between modern artificial intelligence and traditional textual preservation.

Keywords: Artificial intelligence, AI hallucinations, Islamic research, Textual integrity, Digital humanities

The Role of Islamic Education in Developing Future-Ready Muslim Societies

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Education plays a fundamental role in shaping individuals and societies. From an Islamic perspective, education is not limited to the acquisition of knowledge but aims at the intellectual, moral, spiritual, and social development of human beings. This study examines the role of Islamic education in preparing individuals and communities for the challenges of future societies. The Qur'an and Sunnah emphasize the importance of knowledge, reflection, character building, justice, and responsible conduct. These principles provide a comprehensive educational framework that can contribute to the development of balanced and socially responsible individuals. The study explores how Islamic education can cultivate critical thinking, ethical awareness, and respect for others, social responsibility, and a commitment to human welfare. It further argues that future-ready societies require individuals who possess not only knowledge and skills but also strong moral character and a sense of responsibility towards society. Islamic education integrates worldly knowledge with moral and spiritual values, thereby offering a holistic approach to human development. The study concludes that strengthening Islamic educational principles can play a significant role in developing morally conscious, intellectually capable, socially responsible, and inclusive Muslim societies capable of responding effectively to future challenges. The study further highlights the importance of connecting traditional Islamic scholarship with contemporary scientific and technological knowledge to prepare Muslims for complex future challenges. It proposes an educational model that balances intellectual excellence, spiritual development, ethical character, and practical competencies. The paper concludes that a revitalized approach to Islamic education can contribute significantly to building resilient, innovative, ethically conscious, and socially responsible Muslim societies capable of navigating future transformations while preserving their Islamic identity and values.

Keywords: Islamic education, Human development, Moral character, Future societies, Knowledge

Digital Immorality and State Responsibility in Pakistan: A Maqāṣidī Perspective

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This study examines the growing issue of digital immorality among youth in Pakistan and explores the moral and legal responsibilities of the state using the framework of Maqāṣid al-Sharīʿah (Objectives of Islamic Law). The widespread availability of smartphones and unrestricted internet access has created many educational opportunities, but it has also increased exposure to inappropriate online content, cybercrimes, and unethical behavior. This trend negatively affects social values, youth behavior, and traditional family structures. Using a descriptive and analytical research approach, this study evaluates the role of state governance (Siyāsa Sharʿiyyah) alongside existing laws, such as the Prevention of Electronic Crimes Act (PECA) and policies set by the Pakistan Telecommunication Authority (PTA). The findings suggest that current legal measures are often delayed and less effective because of weak enforcement and a lack of preventive policies based on Islamic moral values. By applying Islamic principles such as Sadd al-Dharāʾiʿ (preventing harm before it happens) and protecting fundamental needs like religion (Ḥifẓ al-Dīn), honor (Ḥifẓ al-ʿIrḍ), and intellect (Ḥifẓ al-ʿAql), this research suggests a practical framework for the state. It highlights that the state should move beyond basic internet blocking to implement better digital management, clear legal enforcement, and moral education for youth. Overall, this study offers useful recommendations for policymakers, regulators, and educators to reduce digital harms while protecting moral values in society.

Keywords: Digital immorality, State responsibility, Pakistan, Maqasid al-Shariah, Cyber laws

From Hisbah to Environmental Governance: An Islamic Framework for Public Welfare and Disaster Management

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Environmental degradation and natural disasters have become significant challenges for societies and governments, particularly in regions frequently affected by floods and other environmental hazards. Contemporary approaches to these challenges largely focus on environmental regulation, disaster management, and institutional responsibility. However, Islamic intellectual tradition also contains principles concerning public welfare, prevention of harm, and social responsibility that may contribute to contemporary discussions of environmental governance. This study explores the concept of Hisbah and examines its relevance to environmental governance and disaster management from an Islamic perspective. Historically, Hisbah functioned as an institution concerned with promoting public good, preventing harmful practices, and protecting the interests of society. This study investigates these functions through selected classical Islamic sources and examines the principles underlying them, particularly public welfare (maslahah), prevention of harm (darar), and collective responsibility. The study employs a qualitative, historical, and analytical methodology, combining textual analysis of classical sources with relevant contemporary academic literature. These principles are examined in relation to contemporary environmental challenges, with particular attention to floods and disaster-related risks. The study argues that Hisbah may be understood beyond its historical institutional form as a source of broader ethical principles concerning public welfare and the prevention of harm. It explores how these principles can contribute to contemporary discussions of environmental governance and disaster management without presenting Islamic jurisprudence as a substitute for modern environmental institutions. The research aims to establish a conceptual connection between the classical institution of Hisbah and contemporary concerns of environmental responsibility and public welfare.

Keywords: Hisbah, Environmental Governance, Disaster management, Public welfare (Maslahah), Prevention of harm (Darar), Islamic Jurisprudence

AI-Generated Religious Knowledge and the Problem of Trust: Developing an Islamic Framework for Verification

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Artificial Intelligence (AI) is becoming a common part of our daily lives. People now use AI tools not only for education and general information but also to ask questions about Islam, the Qur'an, Hadith, Islamic teachings, and religious practices. Receiving an answer within seconds is easy and useful, but it also creates a serious concern: Can we trust the religious information provided by AI? Sometimes, AI may provide an incorrect reference, present a weak or fabricated Hadith, or explain a religious matter without considering its proper context. This can create confusion, especially for people who do not have sufficient knowledge to verify the information themselves. This study examines the issue of trust in AI-generated religious knowledge from an Islamic perspective. It focuses on the Islamic principle of verification (تَثَبُّت) and examines guidance from the Qur'an, Sunnah, and traditional methods of Islamic scholarship. The study adopts a qualitative and analytical approach to explore how these principles can be applied to AI-generated religious content. It further highlights the importance of consulting authentic sources and qualified Islamic scholars when dealing with sensitive or complex religious questions. The study aims to develop a simple Islamic framework for checking, verifying, and evaluating religious information before accepting or sharing it. It emphasizes that technological convenience should not replace scholarly responsibility or critical examination. The study argues that AI can serve as a useful supporting tool for accessing and organizing Islamic knowledge, but it should not be treated as a final religious authority without proper verification. Responsible use of AI requires source checking, contextual understanding, and guidance from authentic Islamic scholarship.

Keywords: Artificial intelligence, Islamic Knowledge, AI-Generated content, Verification, Trust, Qur'an, Sunnah, Religious authority

Youth and the Future of Islamic Society

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Young people are a vital force in shaping the future of Islamic society. From an Islamic perspective, youth are entrusted with knowledge, moral responsibility, and the ability to contribute positively to their families, communities, and wider society. Islam encourages the pursuit of beneficial knowledge, good character, justice, compassion, consultation, and responsible leadership. In the contemporary world, rapid technological development and social change have created both opportunities and challenges for young Muslims, including misinformation, materialism, social pressure, and the misuse of digital platforms. This study explores the role of Islamic teachings in guiding youth to respond to these challenges while actively contributing to education, innovation, social development, and community welfare. It argues that a successful future Islamic society requires young people who can combine faith and moral values with modern knowledge, critical thinking, creativity, and social responsibility. By developing strong character and a sense of purpose, youth can become constructive leaders and agents of positive change. The study concludes that the progress of Islamic society depends not only on scientific and technological advancement but also on nurturing an ethically grounded, educated, responsible, and socially conscious generation.

Keywords: Islamic Society, Youth, Islamic Ethics, Moral Development, Education, Leadership, Social Responsibility, Innovation, Technology, Character Building

Social Justice and Equality in Future Societies: An Islamic Approach

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The emergence of future-ready societies is increasingly shaped by technological advancement, globalization, economic transformation, and changing social structures. These developments create new opportunities for human progress but also generate challenges related to inequality, discrimination, poverty, access to education, and social exclusion. Islam provides a comprehensive ethical and social framework that places justice (adl), equality, human dignity (karamah), compassion, and social responsibility at the center of human development. This study examines the Islamic approach to social justice and equality and explores its relevance for building inclusive and sustainable future societies. Drawing upon the Qur'an, Sunnah, and principles of Islamic jurisprudence, the research highlights that justice is not merely a legal requirement but a moral and collective responsibility. The Qur'anic emphasis on justice, equitable treatment, protection of human dignity, and assistance to vulnerable groups provides significant guidance for addressing contemporary social inequalities. The study further examines the Islamic principles of economic justice, equal human worth, educational opportunities, welfare, and protection of basic rights. It argues that the application of these principles can contribute to societies in which technological and economic progress is accompanied by ethical responsibility and social inclusion. The research concludes that an Islamic framework of justice can offer a valuable perspective for future-ready societies by balancing individual rights with collective welfare and material development with moral values. Such an approach can strengthen social cohesion, reduce inequality, and promote a more equitable and dignified future for humanity.

Keywords: Social justice, Equality, Islamic perspective, Future-ready societies, Human dignity

Islamic Principles of Youth Empowerment for Future-Ready Societies: Ethics, Leadership, and Civic Participation

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Youth constitute a vital human resource for the development, stability, and transformation of societies. In an era characterized by rapid technological advancement, economic uncertainty, environmental challenges, social change, and evolving ethical concerns, empowering young people has become essential for building future-ready societies. Islam provides a comprehensive framework for youth empowerment that extends beyond economic and professional development and emphasizes knowledge, moral character, responsibility, leadership, and social participation. This paper examines the Islamic perspective on youth empowerment and its relevance to preparing young people for contemporary and emerging challenges. The study analyses relevant Qur'anic principles, Prophetic teachings, and examples from the early Islamic period to identify the intellectual, moral, social, and leadership qualities expected of young Muslims. Particular attention is given to the Islamic emphasis on the pursuit of knowledge, development of skills, self-discipline, consultation, social responsibility, and constructive participation in society. The paper also highlights how the Prophet Muhammad (peace be upon him) entrusted young Companions with significant responsibilities, demonstrating that youth should be regarded not merely as beneficiaries but as active contributors to societal progress. The study argues that an effective Islamic approach to youth empowerment should integrate religious and ethical values with education, technological competence, critical thinking, creativity, entrepreneurship, and civic responsibility. It concludes that Islamic principles provide a balanced framework for developing capable, ethical, resilient, and socially responsible youth who can contribute meaningfully to sustainable and future-ready societies.

Keywords: Islamic Youth empowerment, Future-Ready societies, Islamic ethics, Youth leadership, Social responsibility

Promoting Interfaith Dialogue and Tolerance in Future Societies: An Analytical Study in Light of Qur'anic Principles of Dawah

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Interfaith relations become difficult when disagreement is treated as a threat and communities have no fair means of communication. The Qur'an directs religious engagement toward wisdom, respectful speech, reasoned discussion, and patience. It does not make coercion or hostility the basis of dawah. The Prophet Muhammad (peace be upon him) put these principles into practice in Medina, where communities with different beliefs retained their religious freedom and accepted shared civic responsibilities. This study explores the relevance of that approach to interfaith relations in future societies. It uses a descriptive and analytical reading of the Qur'anic principles of dawah alongside current social conditions. The Qur'anic model views dialogue as a way of seeking understanding and establishing fair relations, not as a contest in which one side must defeat the other. Tolerance that leaves injustice untouched cannot provide lasting peace. Political pressure, unequal treatment, or the exclusion of minorities can quickly damage an apparently stable society. Respect for human dignity, equal rights, and honest communication are therefore necessary. Qur'anic communication ethics can guide schools, religious institutions, and civic bodies in building these habits. They give diverse communities a basis for cooperation on matters of common welfare while allowing each group to preserve its religious identity.

Keywords: Future societies, Interfaith dialogue, Religious tolerance, Qur'anic principles of Dawah, Social cohesion

Countering Fake News and Societal Disruption in the Digital Age: An Applied Study in Light of Qur'anic Communication Principles and the Seerah of Prophet Muhammad ﷺ

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False or distorted information can now reach a large audience before its source or accuracy has been examined. The result may be public fear, damage to a person's reputation, conflict within families, and sharper divisions between communities. Qur'anic communication ethics addresses this danger by requiring verification, restraint, and respect for human dignity. The Prophet Muhammad ﷺ also warned against repeating a report without checking it. This study applies these principles to the problem of fake news in future-ready societies. It brings Qur'anic guidance and the Seerah into discussion with present digital-media practices through a descriptive-analytical and applied approach. Verification is necessary, but it cannot work without personal responsibility. People must also learn to resist suspicion, avoid forwarding unconfirmed claims, and consider the harm caused by public accusations. The early Madinan community responded to disruptive rumours with investigation, consultation, solidarity, and accountability. These measures can inform digital-literacy programmes, educational policy, and media regulation. Legal penalties and technical tools may remove some harmful material, but they cannot create responsible communication on their own. Qur'anic and Prophetic standards can help users treat truthfulness as a public duty, allowing digital media to support knowledge and cooperation instead of weakening trust.

Keywords: Fake News, Digital media ethics, Societal Cohesion, Tabayyun, Seerah of Prophet Muhammad ﷺ

Conceptualizing Malakah in Khaldunian Pedagogy for Generative AI Mediated-Education

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Generative AI tools such as ChatGPT are transforming contemporary learning, but their use for obtaining instant answers may weaken essential 21st-century skills, including critical thinking, problem solving, and independent reasoning. This study revisits Ibn Khaldun's fourteenth-century concept of Malakah, understood as a deeply internalized skill developed through understanding (al-fahm), sustained practice (al-ittisal), and habituation. It reconstructs this classical concept into an educational framework suited to the age of artificial intelligence. Using a conceptual methodology grounded in Ibn Khaldun's Muqaddimah, the study examines his stages of skill formation and his principle of gradual learning (tadarruj), alongside contemporary literature addressing the cognitive effects of generative AI on learning. Based on this analysis, the study develops the Re-engineering Malakah Framework (RMF), which positions AI as a thinking partner rather than merely an answer generator. Under the RMF, students first attempt learning tasks independently, use AI for guiding hints rather than direct solutions, explain and defend their reasoning, and gradually progress toward more complex tasks until genuine mastery is achieved. The analysis highlights how the conventional AI workflow of "question–answer–submit" can bypass the cognitive processes necessary for developing durable competence. In contrast, the RMF integrates AI into a structured learning process that emphasizes reflection, practice, judgment, critical thinking, and independent reasoning. The study concludes that generative AI does not necessarily have to erode 21st-century skills; when guided by pedagogically grounded frameworks such as the RMF, it can support their development. The framework therefore offers practical implications for curriculum design, teaching practices, assessment, and education policy in the AI era.

Keywords: Malakah, Ibn Khaldun, Generative AI, 21st-century skills, Critical thinking

Modern Old-Age Home Culture and Family Breakdown: A Study of Elderly Care and Societal Stability in Light of Islamic Maintenance Law

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Islamic teaching places the care of ageing parents within the duties of family life. The Prophet Muhammad (peace and blessings be upon him) linked respect for elders with the preservation of family ties and warned against neglect. In many Muslim communities, however, urban living, changing employment patterns, and smaller households have increased reliance on commercial old-age homes. This study examines what that change means for elderly care and family relationships, with particular attention to Pakistan. It compares current social conditions with classical discussions of nafaqah and family responsibility through a descriptive and analytical approach. Sending an older parent to an institution is not always a sign of indifference. Some families lack the time, income, or support needed for home care, while others have gradually treated care as a service that can be transferred to an outside institution. Islamic jurisprudence regards the maintenance of dependent parents as a duty according to ability, not as occasional charity. Families facing genuine hardship also need health services, community assistance, and legal protection. The most workable policy would support care within the family whenever it is safe and possible, while ensuring decent institutional care when it is necessary. Such a balance can protect older people without ignoring present social realities and can help preserve the bonds between generations.

Keywords: Elderly Care, Islamic maintenance (Nafaqah), Old-age homes, Family system, Societal stability

Beyond Technology: Islamic Akhlaq and Tazkiyah for Future Societies

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In today's fast-changing world, science and technology are rapidly reshaping human life, yet material advancement alone has failed to deliver true happiness or peace, leading to severe moral decline, stress, and social conflict. This study explores the Islamic perspective on building futureready societies by evaluating how integrating spiritual purification (Tazkiyah) and moral excellence (Akhlaq) with technological progress can resolve modern ethical crises. Using a qualitative and thematic analytical method, this research examines primary Islamic sources, classic Sufi literature, and contemporary sociological frameworks to analyze the balance between material development and spiritual well-being. The findings reveal that technological innovation without ethical grounding deepens human isolation, whereas applying Islamic moral principles directly restores social justice, emotional health, and communal harmony. By prioritizing the inner refinement of the human heart over mere material consumption, societies cultivate responsible, compassionate individuals who utilize modern tools for collective human welfare. The study concludes that a genuinely sustainable and future-ready society cannot rely solely on scientific infrastructure or economic wealth. Instead, re-aligning modern development with Islamic ethical values provides an essential, practical roadmap for creating a balanced, safe, and spiritually fulfilling world for future generations. The study proposes that future societies should move beyond a technology-centered model of progress toward a human-centered and spiritually grounded paradigm in which technological capabilities are balanced with ethical consciousness. It concludes that integrating Islamic Akhlaq and Tazkiyah into contemporary educational, social, and technological frameworks can contribute to building resilient, responsible, and morally conscious future societies.

Keywords: Islam, Future-ready societies, Akhlaq, Tazkiyah, Ethics

The Seerah and the United Nations 2030 Agenda: A Prophetic Framework for Building Future-Ready Societies

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The UN 2030 Agenda includes 17 interlinked Sustainable Development Goals (SDGs) aimed at tackling systemic socioeconomic poverty, structural inequality, institutional weaknesses, and global ecological degradation. Simultaneously, there is a growing trend among researchers in Muslim-majority countries to study indigenous normative traditions and develop ethically resilient development models based on the cultural values of the societies they belong to. This research paper outlines the Prophetic Biography mapped against the backdrop of the 17 SDGs, with regard to historical institutions, policies, and socio-ethical mandates established in the era of the Prophet (610-632 CE). Through a qualitative doctrinal and historical textual analysis, the research explores the primary Islamic sources, including the Qur'an, the two collections of the authentic prophetic traditions by Al-Bukhari and Muslim, Ibn Hisham's Life of the Prophet, and Al-Mubarakpuri's The Sealed Nectar. The results show significant congruence in all three aforementioned operational forms of institutionalism: direct institutional congruence (for instance, poor-due and public distribution systems in SDG 1; residential academy of Bench Companions in SDG 4; Constitution of Medina in SDG 16); policy-congruence (protected conservation reserves and reclamation in SDGs 13 and 15); and normative-conceptual congruence (anti-extravagance restrictions underlying SDGs 7 and 12). The research asserts that Seerah provides a complete ethics framework based on justice, mercy, dignity, social accountability, and environmental sustainability. It is clear from the findings that the principles of Prophetic ethics could support the current models of sustainable development and create ethically robust and future-proof societies.

Keywords: Seerah, Sustainable development goals (SDGs), United Nations 2030 Agenda, Prophetic Ethics, Future-ready societies

Islamic Perspective for Future-Ready Societies: Truthfulness

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The rapid advancement of technology, globalization, artificial intelligence, and changing social structures is transforming the ways in which societies live, work, communicate, and make decisions. In this evolving environment, building future-ready societies requires not only technological and economic progress but also strong ethical, social, and moral foundations. From an Islamic perspective, future readiness is based on the balanced development of individuals, communities, and institutions through knowledge, justice, responsibility, and human dignity. Islam encourages the pursuit of knowledge and innovation while emphasizing that scientific and technological development should serve humanity and promote social well-being. Principles such as ʿAdl (justice), Amānah (responsibility and trust), Shūrā (consultation), Maṣlaḥah (public welfare), and Iḥsān (excellence) provide an ethical framework for addressing contemporary and emerging challenges responsibly. This perspective also emphasizes the importance of education, sustainable development, social inclusion, economic fairness, environmental responsibility, and ethical governance. In particular, emerging technologies such as artificial intelligence should be developed and utilized with transparency, accountability, privacy, and respect for human values. An Islamic framework therefore views the future not merely as a period of technological advancement but as an opportunity to develop societies that are innovative, resilient, inclusive, and morally responsible. This paper explores how Islamic principles can contribute to the development of future-ready societies by connecting modern innovation with ethical values and collective welfare. It argues that integrating technological progress with Islamic ethical principles can help societies prepare for future challenges while preserving human dignity, justice, social harmony, and sustainable development.

Keywords: Islamic ethics, Artificial intelligence, Ethical Governance, Human Dignity, Sustainable Development, Social justice

Maqasid Al-Shariah, Scientific Advancement and STEAM Education: Towards Sustainable Future-Ready Societies

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The rapid advancement of science is reshaping the social life, education and economics, opening up new opportunities but also posing difficult ethical, environmental and social questions. In this regard STEAM education has emerged as an important approach to foster creativity, critical thinking, problem-solving and innovation. But technology advancement without an ethical compass can lead to outcomes which are contrary to human dignity, social justice and the collective well-being. This paper discusses the importance of Maqasd ul Shriah as an ethical and educational framework to guide scientific progress and STEAM education toward sustainable and future-ready socities It examines how the higher objectives of Shriah can guide the aims, substance and moral direction of STEAM education. This paper contends that Maqasd al Shriah can offer a value-based framework for assessing whether scientific and technological developments truly lead to human flourishing and sustainable development. Embedding Maqasid-based ethical reflection in STEAM education can help student learn to associate innovation with responsibility, creativity with wisdom and technological competence with social benefit. It concludes that sustainable future readiness requires not only technical competence but also morally responsible, critically conscious and socially engaged individuals who are able to apply scientific knowledge and innovations in the service of humanity, protection of creation and balanced development. Such integration provides Muslims educational institutions with a consistent approach to reconcile contemporary STEAM learning with the timeless ethical goals and societal demands of Islam. It links educational innovation to ethical accountability, resilience, sustainability and long-term human welfare.

Keywords: Maqasd ul Shriah, STEAM Education, Scientific advancement, Islamic ethics, Sustainability

Preservation of Wealth and Modern Economic Crises: A Maqasid-Based Analytical Study for Solutions

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The contemporary global and local economies are persistently plagued by severe crises of instability, inflation, currency devaluation, and debt-based interest systems. Consequently, real savings and purchasing power are severely eroded, directly impacting on fundamental human rights and social harmony. Grounded in the imperative of Hifz al-Mal (Protection of Wealth) a fundamental pillar of *Maqasid al-Shariah* (Objectives of Islamic Law), this research presents a scientific and Islamic analysis of the root causes underlying modern economic crises. This study demonstrates that wealth in Islam is not merely an economic utility, but a fundamental trust (Amanah). To safeguard this trust, Shariah employs a possible dual strategy: positive/constructive aspects (Al-Jalb) promoting wealth circulation, investment, and equitable distribution; and preventative aspects (*Al-Daff*) prohibiting usury (*Riba*), hoarding (*Ihtikar*), uncertainty (*Gharar*), and financial exploitation. Adopting a qualitative and analytical methodology, the primary findings reveal that the current fiat and digital currency-based monetary system erodes real purchasing power through inflation, contradicting the Islamic principles of economic justice. To mitigate contemporary economic crises, the paper proposes three core interventions: Promoting asset-backed and risk-sharing financial models. Reviving inflation-hedged Islamic financial instruments and gold/commodity hybrid models. Leveraging blockchain technology and smart contracts to ensure transparency and fulfill the mandates of Hifz al-Mal.

Keywords: Protection of wealth (*Hifz al-Mal*), Economic crises, Inflation, Monetary value

Sufi Ethical Education and Inter-Religious Cohesion: Exploring Pathways of Social Healing in Higher Education

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Sufism, with its profound spiritual beliefs, distinctive practices, and rich cultural traditions, has remained a significant dimension of Islamic intellectual and spiritual heritage. Within the broader spiritual and cultural traditions of Islam, Sufi teachings offer an ethical framework centred on love, compassion, humility, tolerance, reconciliation, and service to others. These values provide a meaningful basis for strengthening relationships among individuals and communities across religious and social differences. This study explores how Sufi ethical education can contribute to inter-religious cohesion within higher education and, consequently, support processes of social healing. The study adopts a qualitative approach based on semi-structured, in-depth interviews with faculty members and relevant educational and religious stakeholders. It examines how participants understand Sufi ethical principles and their potential application within educational practices and institutional environments. Particular attention is given to compassion, tolerance, respect for diversity, ethical responsibility, reconciliation, mutual understanding, and peaceful coexistence. The central argument of the study is that Sufi ethical education can move beyond the transmission of spiritual values by translating them into everyday practices of dialogue, mutual recognition, cooperation, and peaceful coexistence. In this context, higher education can serve as a space where ethical and spiritual principles are experienced through interpersonal relationships and collective practices, enabling individuals from diverse religious and social backgrounds to develop stronger mutual respect, belonging, and shared responsibility. The study therefore positions Sufi ethical education as a potential pathway through which higher education can strengthen inter-religious cohesion, address social divisions, and contribute to social healing. It further highlights the relevance of integrating culturally grounded ethical perspectives into educational discourse to promote inclusive learning environments, constructive inter-religious engagement, and more harmonious social relations.

Keywords: Sufism, Ethical Education, Inter-religious Cohesion, Social healing, Higher education

Farmers' Economic Stability Through Government Policies and Facilitation for Agricultural Development: An Islamic Perspective for Future-Ready Society

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Agriculture plays a fundamental role in economic development, food security, employment, and the stability of rural societies, while farmers are the basic stakeholders of the agricultural system. However, contemporary farmers face various challenges, including rising costs of agricultural inputs, inflation, inadequate irrigation facilities, limited access to agricultural credit, climate change, fluctuating market prices, limited market access, and insufficient access to modern agricultural technologies. These challenges affect farmers' economic stability and create obstacles to sustainable agricultural development. This study aims to examine government policies and agricultural facilitation for farmers from an Islamic perspective and to analyze their role in promoting farmers' economic stability and agricultural development. The study will focus on agricultural credit, quality seeds and fertilizers, irrigation facilities, modern agricultural technology, fair crop prices, market access, agricultural guidance, crop protection, and government support during natural disasters and economic crises. Islamic teachings emphasize justice, economic fairness, cooperation, public welfare, moderation, honesty, and protection from exploitation. In the light of the Qur'an and Sunnah, this study will examine the principles related to the responsibilities of the state, protection of economic rights, and promotion of public welfare. It will also analyze practices such as exploitation, hoarding, unfair pricing, and economic injustice that can negatively affect farmers. The study seeks to develop an Islamic framework for farmer-oriented government policies and agricultural facilitation that can protect farmers' economic rights, improve agricultural productivity, strengthen food security, promote rural prosperity, and contribute to sustainable agricultural development. It argues that policies based on justice, transparency, welfare, and responsible facilitation can play an important role in building resilient and future-ready societies.

Keywords: Farmers' Economic stability, Government policies, Agricultural development, Government facilitation, Economic justice, Farmers' Rights, Food security, Sustainable development, Islamic perspective

From Recitation to Reformation: Integrating Qira'at Sciences into the Educational Blueprint of Future Societies

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As societies are changing rapidly with new technologies, globalization and moral confusion the need of the hour is to impart a new educational model that combines technical skills with spiritual and moral development. This paper discusses the science of Qiraat which are Islamic modes of reciting the Qur'an as a basic material for creating such an educational blueprint. Qira'at is not just a devotional art but a rigorous oral-aural pedagogy which ensures the precision of the text, memory, pronunciation and continuity of transmission. It develops the skills of discipline, a contemplative ear and character development that are becoming more and more essential in information-rich, attention-shortage digital spaces. The study suggests that the integration of Qira'at sciences into the modern curriculum of primary to higher education can revolutionize the recitation into reformation that affects the cognition, the ethical aspect and the identity. The paper puts forth a framework for adapting Qira'at into future-oriented Islamic education based on a qualitative analysis of classical Qira'at literature the modern educational theory and case studies on the models of madrasa and hybrid learning. This approach highlights teacher training, digital archives, interactive recitation platforms and interdisciplinary links with linguistics, neuroscience and character education. It also responds to issues like standardization, access and the potential of the Qiraat becoming performance. The paper concludes that a future ready society cannot give up on the embodied and transmitted knowledge in the name of pure innovation but should embrace Qira'at as a moving, learning pole to create resilient, ethical and culturally rich communities. The study provides an Islamic perspective on lifelong learning, identity preservation and sustainable societal development by recasting the concept of Qira'at from ritual recitation to educational reformation.

Keywords: Qira'at sciences, Islamic education, Digital pedagogy, Identity preservation

Islamic Leadership and Good Governance: A Framework for Future-Ready Societies

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In the contemporary world, societies are experiencing rapid technological, economic, social, and environmental transformations. These changes require effective leadership and governance systems that can promote justice, accountability, inclusiveness, and sustainable development. Islamic teachings provide a comprehensive framework of leadership and governance based on ethical responsibility, justice, consultation, trust, and public welfare. This paper explores the role of Islamic leadership and good governance in developing future-ready societies capable of responding effectively to emerging global challenges. The study examines key Islamic principles of leadership, including justice (Adl), trustworthiness (Amanah), consultation (Shura), accountability, equality, and public welfare (Maslahah). These principles emphasize that leadership is not merely a position of authority but a responsibility towards society. Islamic governance encourages leaders to make decisions through consultation, protect the rights and dignity of individuals, ensure social justice, and prioritize the collective well-being of communities. Such principles are particularly relevant in the modern era, where societies face challenges such as corruption, inequality, weak institutions, misinformation, technological disruption, and environmental crises. The paper argues that integrating Islamic ethical principles with contemporary governance practices can contribute to transparent, responsible, inclusive, and sustainable institutions. Islamic leadership can also promote human-centered development by encouraging education, innovation, social responsibility, and equal opportunities for all members of society. The study further highlights the importance of accountable leadership in building public trust and strengthening social cohesion. The paper concludes that Islamic principles of leadership and good governance offer a valuable ethical framework for building future-ready societies. By combining moral responsibility with modern governance mechanisms, societies can achieve sustainable development while protecting human dignity, justice, and public welfare.

Keywords: Islamic leadership, Good governance, justice, shura

Safeguarding Fundamental Human Rights and Social Justice in Contemporary Societies: A Comparative Study of Islamic Principles and Modern Citizenship

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Modern constitutions recognize a wide range of rights, yet many societies continue to experience unequal treatment, selective justice, and the exclusion of vulnerable people. The Charter of Medina provides an early example of a civic order in which communities with different faiths shared duties and received mutual protection. This study compares that Islamic approach to social justice and fundamental rights with the modern concept of citizenship. The analysis draws on Qur'anic guidance, Prophetic practice, the administration of the Rightly Guided Caliphs, and selected constitutional principles. Modern citizenship generally depends on legal status and membership of a state. Its protections may become uncertain when nationalism or political pressure determines whose rights are fully respected. Islamic teaching begins with the dignity of every human being and treats the protection of life, faith, property, and intellect as a public and moral duty. This position gives rights a basis that does not depend entirely on political approval. The comparison suggests that law alone cannot remove injustice if officials and citizens lack a sense of responsibility toward others. Ethical obligations of fairness and mutual welfare can strengthen legal citizenship. Their inclusion in public policy would help address structural inequality and support more peaceful, resilient, and future-ready societies.

Keywords: Social justice, Fundamental rights, Islamic governance, Modern citizenship

Spiritual Enlightenment and Moral Development: The Quranic Vision for a Better Society

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Modern societies have made remarkable progress in science, communication, medicine, and technology. However, despite these advancements, many communities continue to face serious challenges, including dishonesty, injustice, inequality, loneliness, and a decline in moral values. These challenges highlight the limitations of material progress when it is not accompanied by spiritual awareness and ethical development. The Holy Quran presents a comprehensive vision of human well-being in which spiritual enlightenment, moral responsibility, and social welfare are closely interconnected. This paper explores the Quranic perspective on spiritual enlightenment and moral development, emphasizing the significance of Tazkiyah al-Nafs (purification of the soul), Ihsan (excellence in conduct), remembrance of Allah, accountability, compassion, and service to humanity. Drawing upon selected Quranic passages and the well-known Prophetic explanation of Ihsan, the study examines how spiritual consciousness can strengthen personal integrity, promote justice, encourage responsible leadership, and foster peaceful relationships within society. It further highlights the importance of integrating Quranic moral principles into educational systems, technological advancement, public institutions, and sustainable social development. The paper argues that genuine societal progress requires more than scientific knowledge, economic growth, and technological innovation. It demands individuals who combine intellectual competence with spiritual maturity, ethical judgment, and a commitment to the common good. By cultivating inner purification and moral excellence, individuals can contribute to stronger families, trustworthy institutions, inclusive communities, and responsible future-ready societies. The Quranic vision therefore offers a meaningful framework for addressing contemporary moral challenges and building a society grounded in justice, compassion, integrity, and collective responsibility.

Keywords: Spiritual enlightenment, Tazkiyah al-Nafs, Ihsan, Quran, Moral development, Social responsibility, Future-ready societies

AI Ethics in Islam: Islamic Principles of Responsible Artificial Intelligence for Human-Centered Technological Development

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This study aims to examine the ethical foundations of Artifiial Intelligence (AI) from an Islamic perspective by connecting Islamic ideas of knowledge, wisdom, and human responsibility with contemporary AI ethics. The objective is to identify principles that can guide the responsible development and use of AI, with particular understanding of knowledge and ethical relationship between science, technology and human values. The study utilizes Seyyed Hossein Nasr's *Science and Civilization in Islam* (1968) as the primary source. This research will be supported by recent studies on AI ethics and Islam showcasing that Islamic ethical principle can contribute to discussions about the responsible development and use of emerging technologies. Although recent research examines Islamic teachings as an ethical guidance for AI, limited research connects these discussions with the deeper Islamic understanding of knowledge and science. This study follows a qualitative and interdisciplinary methodology based on textual and thematic analysis. It compares themes from Nasr's work with findings from contemporary AI ethics literature, particularly regarding knowledge, human responsibility, and the ethical use of science and technology. The study will prove to be significant as it will provide a foundation for a more responsible, human-centered, and value-based approach to AI from an Islamic perspective.

Keywords: Artificial Intelligence, AI Ethics, Islamic Ethics, Human Responsibility, Maqasid al-Shariah, Ethical AI Governance

Reimagining Human Responsibility in a Technological World: A Qur'anic Approach to Ethics and Innovation

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Technology has become an integral part of contemporary life, transforming the ways people communicate, learn, work, and make decisions. Emerging technologies, particularly Artificial Intelligence (AI), social media, and digital platforms, offer significant opportunities for innovation, knowledge sharing, and social development. However, these advancements also present serious ethical challenges, including misinformation, privacy violations, algorithmic bias, the misuse of AI, and the declining sense of human responsibility in decision-making. These challenges highlight the need for an ethical framework that ensures technological progress remains aligned with human values and social well-being. This study explores human responsibility in the technological world from a Qur'anic perspective, focusing on the ethical principles that can guide the development and application of modern technologies. The Qur'an emphasizes human accountability, justice, honesty, wisdom, and the responsible use of knowledge and resources. These principles provide a foundation for evaluating technological innovation and addressing its moral implications. Using a qualitative and analytical research methodology, the study examines relevant Qur'anic teachings and relates them to contemporary technological challenges. It particularly considers how Islamic ethical values can inform responsible AI development, digital communication, privacy protection, and decision-making. The study argues that technological advancement should not be evaluated solely in terms of efficiency, convenience, or economic growth. Instead, innovation must also uphold human dignity, protect individual rights, promote justice, and strengthen moral accountability. By integrating Qur'anic ethical principles into discussions of technological development, this research seeks to present a framework for responsible and human-centered innovation. It concludes that a Qur'anic approach can contribute to building a technologically advanced society in which progress is guided by ethical awareness, social responsibility, and the welfare of humanity.

Keywords: Qur'anic Ethics, Human Responsibility, Technology, Artificial Intelligence, Innovation, Moral Accountability

Charting the Future: AI, Sustainability, and Human Values in an Era of Transformation

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The 21st century stands at the intersection of rapid technological advancement and urgent ecological responsibility, demanding a reconsideration of how societies define progress. This paper explores the interconnected roles of artificial intelligence, sustainability, and human-centered values in shaping future-ready societies. It examines how artificial intelligence, intelligent learning systems, and digital transformation are redefining skills, competencies, and educational practices, while emphasizing the ethical boundaries necessary to ensure equitable, inclusive, and responsible outcomes. The study further highlights green innovation and climate action as essential components of technological and educational development rather than separate concerns. The paper also examines the role of policy, leadership, and governance in directing technological innovation toward socially responsible objectives. In addition, it emphasizes the contribution of arts, creativity, and human-centered design in ensuring that technological progress remains aligned with human dignity, social well-being, and cultural values. A distinct dimension of the discussion incorporates Islamic perspectives on ethics, responsibility, and stewardship, providing a value-based framework for evaluating technological and environmental transformation. Concepts such as responsible stewardship, justice, balance, and moral accountability offer meaningful guidance for addressing the challenges associated with rapid innovation. By synthesizing these interconnected dimensions, the paper proposes an integrated model of progress that balances innovation with wisdom, efficiency with equity, and economic development with environmental sustainability. It argues that future-ready societies require not only technological capabilities but also ethical awareness, responsible governance, human creativity, and sustainable practices. The paper aims to contribute to contemporary academic and policy discourse on developing resilient, ethical, inclusive, and sustainable societies capable of navigating technological and environmental complexity with clarity and purpose.

Keywords: Artificial Intelligence, Sustainability, Human-Centered Innovation, Ethical Governance, Islamic Ethics, Future-Ready Societies

An Islamic Framework for Balancing Technological Advancement and Ethical Values to Promote Sustainable Society

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The rapid advancement of technology is transforming societies, reshaping human interactions, and creating new opportunities for education, communication, healthcare, and economic development. However, technological progress without ethical direction may also contribute to social instability, privacy concerns, misinformation, inequality, and the weakening of moral values. This paper explores an Islamic framework for developing future-ready societies by examining how technological advancement can be balanced with ethical and spiritual values derived from the Qur'an and Sunnah. The study adopts a qualitative and analytical approach, focusing on relevant Qur'anic principles and Prophetic teachings concerning knowledge, responsibility, justice, human dignity, moderation, and accountability. The Qur'anic emphasis on seeking knowledge and reflecting upon creation provides a foundation for intellectual and technological development, while Islamic ethical principles establish boundaries for the responsible use of technology. The study argues that Islam does not oppose technological advancement; rather, it provides moral guidance to ensure that scientific and technological capabilities serve humanity and promote social well-being. Particular attention is given to the principles of accountability, justice, preservation of human dignity, and responsible innovation. The paper concludes that a future-ready society should not be measured solely by technological sophistication but also by its capacity to integrate ethical responsibility with intellectual and scientific progress. An Islamic framework can therefore contribute to the development of societies that are technologically advanced, morally responsible, socially just, spiritually grounded, and capable of addressing emerging challenges through balanced ethical decision-making, while encouraging innovation, social inclusion, and responsible participation in an increasingly interconnected global environment for all societies.

Keywords: Islam, Technology, Ethics, Qur'an, Future-Ready Societies

Energy Conservation by Individuals for Future-Ready Societies in Islamic Perspective

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Energy conservation at the individual level is an essential element of sustainable development and environmental protection. The growing demand for energy, rapid urbanization, population growth, and excessive consumption of natural resources have created prominent challenges for modern societies. Although governments and industries play a vital role in reducing energy consumption, individual actions can also make a purposeful contribution to energy efficiency and environmental sustainability. This paper explores the importance of energy conservation in daily life and examines how individual behaviors can reduce unnecessary energy consumption. Simple practices such as switching off lights and electrical appliances when not in use, using energy-efficient appliances, reducing excessive heating and cooling, utilizing natural light and ventilation, and adopting sustainable transportation can significantly improve energy efficiency. Energy conservation also requires awareness, responsible consumption, and behavioral changes among individuals. From an Islamic perspective, avoiding wastefulness and using natural resources responsibly are important ethical responsibilities. The principle of avoiding *Israf* (wastefulness) encourages individuals to use energy and other resources carefully and efficiently. Individual energy-saving practices can reduce household energy costs, lower greenhouse gas emissions, conserve natural resources, and support a healthier environment for future generations. Therefore, promoting energy-conscious behavior through education, awareness, and responsible lifestyles can support create sustainable communities. The study emphasizes that collective environmental improvement begins with responsible individual choices and consistent everyday actions.

Keywords: Energy conservation, Individual behavior, Israf, Energy saving, Natural resources, Future ready societies

Concept of Society and the Islamic Perspectives in the Modern World

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Perpetual and fast scientific, technological, environmental, economic and social advancements and the transformations have questioned the survival of the societies as whole for the future. This rapidness has extended an uncertain future and challenged the humanity. The following article explores and investigates the idea or concept of a future-ready society only in an Islamic perspective.It points out that Islamic thought provides a comprehensive framework for societal preparedness based on, knowledge, ethical responsibility, and institutional accountability with future orientation outlook. Depending upon the Qur'anic outlook the teachings based on Sunnah and Hadiths, aligning with the objectives of Shari'ah (Maqasid al-Shari'ah), and the contributions of classical and contemporary Muslim scholars, the study identifies the foundational principles of tawhid (divine unity), khilafah (stewardship), 'ilm (knowledge), 'adl (justice), and shura (consultation) administration and future exposures and points of the view. It also examines Islam's approach towards innovation, adaptation, and then and even enlightenment. The article examines eleven interconnected dimensions of future readiness: which include spiritual; educational; scientific and technological; economic; social and familial; political; environmental; health; cultural and media; global peace and cooperation; and disaster resilience. It further considers Islamic perspectives on governance and the state, because societies cannot stand alone without a form in state. The study concludes that future readiness depends on moral and civilizational responsibility as societies can stand as a whole based on morals and values.

Keywords: future-ready society, Islamic perspective, Maqasid al-Shari'ah, Ijtihad and tajdid, Islamic governance, innovation, Development, ethics, Muslim civilization, system

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