IRIC

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BOOK OF ABSTRACTS

Innovating for a Sustainable Future: Harnessing Science, Technology, and Innovation for Global Advancement

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Editors
Kaisu Mohammed
Felix Nti Koranteng

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Founding Editors
Kaisu Mumuni
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The *International Research Initiatives Conference (IRIC)* has established itself as a leading platform for the dissemination of innovative research and interdisciplinary dialogue across fields such as science and technology, business and entrepreneurship, education, health, and energy and environment. Over the years, IRIC has built strong collaborations with the global research community, attracting contributions from distinguished academics, industry experts, and emerging scholars.

The mission of IRIC is to provide an invaluable service to the international research community by offering a high-quality venue for the presentation and publication of conference and workshop proceedings. Through its annual gatherings, IRIC promotes knowledge exchange, fosters collaboration, and supports the advancement of research that addresses both theoretical development and real-world challenges.

Preface

The International Research Initiatives Conference (IRIC) is a multidisciplinary platform that brings together researchers, practitioners, and policymakers to advance dialogue on innovative research and its applications to real-world challenges. IRIC emphasizes the integration of knowledge across fields, with a strong focus on areas such as science and technology, business and entrepreneurship, education, health, and energy and environment. The conference serves as a hub for knowledge exchange where participants critically examine current trends, propose novel solutions, and strengthen collaborations between academia and industry.

Over the years, IRIC has grown into a key venue for presenting research that not only advances scholarly understanding but also addresses societal needs. IRIC fosters interaction among international researchers and practitioners by providing fertile ground for discussions that span methodological insights, technological innovations, and practice-oriented applications. Its central mission is to support the dissemination of cutting-edge research while encouraging interdisciplinary collaborations that have the potential to create lasting global impact.

The 2025 edition of IRIC was held from 12–13 August 2025, bringing together participants from across the world in both academic and professional domains. The conference featured keynote sessions, paper presentations, and panel discussions that reflected on the evolving landscape of research and innovation. A defining feature of IRIC 2025 was its commitment to supporting early-career researchers by offering opportunities to refine their work before publication and to network with senior scholars and experts.

We extend our deepest gratitude to the authors, reviewers, organizing committee, and participants whose dedication made IRIC 2025 a success. Special recognition is owed to the Accra Institute of Technology, our partner institution, as well as to the sponsors whose support made this year's conference possible. We hope that the ideas, discussions, and collaborations initiated during IRIC 2025 will inspire future research directions and continue to advance both scholarship and practice.

Kaisu Mumuni
Felix Nti Koranteng

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INFORMATION TECHNOLOGY AND INNOVATION

Exploring the Drivers of Information Security Policy Compliance Among Contingent Employees: A Social, Deterrent, and Involvement-Based Approach

Kaisu Mumuni[1], Felix Nti Koranteng[1], Eugen Marfo Akoto[1], Vasty Ansomaah Adomako[1]

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Abstract

As institutions increasingly depend on Information Systems (ISs), ensuring compliance with Information Systems Security Policies (ISSPs) is critical, especially among contingent employees, whose engagement differs from permanent staff. This study examines how Subjective Norms, Deterrence (certainty of detection and severity of punishment), and involvement mechanisms (knowledge sharing and collaboration) influence contingent employees' Attitudes Toward ISSPs and, ultimately, their Compliance Intentions. Drawing on data from Ghanaian universities and analyzed using PLS-SEM, the findings confirm that all proposed factors significantly shape attitudes, with knowledge sharing having the strongest effect. Attitude toward ISSPs also strongly predicts compliance intentions. The results support integrating social, cognitive, and collaborative factors into existing ISSP compliance models. Practical implications emphasize fostering inclusive and supportive environments alongside enforcement. This study advances theory and provides a foundation for future research into ISSP behavior among temporary academic staff.

Blockchain for Transparent Credentialing in Business Schools in Enugu State, Nigeria

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Abstract

The increasing prevalence of fraudulent academic credentials poses a significant challenge to the credibility of business education, particularly in emerging regions like Enugu, Nigeria. This study investigates the application of blockchain technology for transparent credentialing in business schools within Enugu, focusing on its potential to enhance trust, security, and efficiency in academic record management. Blockchain's decentralized, immutable, and transparent ledger system was implemented in a pilot study involving three business schools in Enugu, utilizing a private blockchain network to issue and verify digital certificates. The system employed smart contracts to automate credential issuance and verification, reducing administrative overhead and mitigating risks of falsification. Quantitative analysis revealed a 40% reduction in verification time and a 50% decrease in reported credential fraud incidents compared to traditional methods. Qualitative feedback from stakeholders, including students, administrators, and employers, highlighted improved trust and accessibility. However, challenges such as limited technological

infrastructure, high initial implementation costs, and the need for stakeholder training were identified. This research demonstrates blockchain's transformative potential for transparent credentialing in Enugu's business schools, offering a scalable model for other developing regions while emphasizing the need for supportive policies and infrastructure development.

Keywords: blockchain technology, transparent credentialing, digital certificates, smart contracts, decentralization

Virtual Reality for Experiential Business Training

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Abstract

Virtual reality (VR) has emerged as a powerful tool for experiential learning, offering immersive environments that simulate real-world business scenarios. This study examines the effectiveness of VR-based experiential training in enhancing decision making, leadership, and problem-solving skills among business professionals. Conducted with 200 participants from diverse business sectors, the research deployed VR simulations replicating complex workplace challenges, such as crisis management, negotiation, and strategic planning. Using a controlled experimental design, participants were divided into VR-trained and traditional training groups. Quantitative results showed a 38% improvement in decision-making accuracy and a 44% increase in leadership confidence among the VR group compared to the control group. Qualitative data from participant interviews revealed higher engagement and knowledge transfer due to VR's interactive and realistic settings. The study also identified barriers, including high setup costs and the need for technical expertise, which could limit scalability. These findings highlight VR's potential to revolutionize business training by providing safe, repeatable, and dynamic learning experiences,

while underscoring the importance of addressing accessibility and cost challenges for broader adoption.

Keywords: virtual reality, experiential learning, business training, immersive simulations.

Augmented Reality for Hands-On Technical Skill Development in Enugu State, Nigeria

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Abstract

Augmented reality (AR) offers transformative potential for technical skill development by providing interactive, hands-on learning experiences in resource constrained settings. This study evaluates the impact of AR-based training on technical skill acquisition among vocational learners in Enugu State, Nigeria, focusing on fields such as electrical installation, automotive repair, and plumbing. An AR platform, utilizing mobile devices and wearable headsets, was deployed to deliver guided simulations and real-time overlays for 150 trainees across three technical colleges in Enugu. The intervention was assessed using a pre- and post-training experimental design, measuring skill proficiency, task completion time, and learner confidence. Results indicated a 35% increase in skill proficiency and a 28% reduction in task completion time compared to traditional training methods. Qualitative feedback highlighted AR's ability to enhance understanding of complex processes through visual and contextual guidance, particularly for learners with limited prior exposure. Challenges included inconsistent internet access, device availability, and the need for instructor training. This study underscores AR's efficacy in bridging skill gaps in Enugu's technical education sector, offering a scalable model for developing regions while emphasizing the need for infrastructure investment and capacity building.

Keywords: augmented reality, technical skill development, hands-on training, vocational education.

Multimodal Machine Translation for Endangered Languages

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Abstract

The preservation of endangered languages is critical for cultural heritage and linguistic diversity, yet limited resources and sparse data pose significant challenges for translation efforts. This study investigates the efficacy of multimodal machine translation (MMT) systems in facilitating the translation of endangered languages, focusing on Igbo, a low-resource language spoken in Enugu State, Nigeria. By integrating text, speech, and visual inputs, an MMT model was developed using a transformer-based architecture enhanced with cross-modal attention mechanisms. The model was trained on a curated dataset comprising 10,000 parallel Igbo-English sentences, audio recordings, and culturally relevant images. Evaluated on a test set of 2,000 samples, the MMT system achieved a BLEU score of 32.5, a 28% improvement over text-only machine translation models, and demonstrated robust performance in contextual disambiguation. Qualitative analysis from native Igbo speakers indicated high translation fidelity, particularly for culturally nuanced expressions. Challenges included data scarcity, computational resource demands, and the need for community driven annotation. This research highlights MMT's potential to support endangered language revitalization, offering a scalable framework for other low-resource languages while emphasizing the importance of collaborative data collection and infrastructure investment.

Keywords: multimodal machine translation, endangered languages, Igbo, cross-modal learning, language preservation, cultural heritage.

The Application of Artificial Intelligence (AI) As A Panacea for Achieving Sustainable Quality Assurance in Tertiary Institutions.

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Abstract

This study explored the application of artificial intelligence (AI) as a panacea for achieving sustainable quality assurance in tertiary institution in Nigeria. The specific objective includes: to examine the assessment of automated grading on feedback mechanism and to explore AI as a tool for enhancing research skills. The data utilized for the study were extracted through responses of the questionnaires distributed. The study adopted frequency and percentage tables for the analysis. The study revealed that major percentage noted that automated grading has positive and improved effect on feedback mechanism, the study also revealed that AI is an effective tool for enhancing research skills. The study concludes that the application of artificial intelligence (AI) has positive and effective influence on achieving sustainable quality assurance in tertiary institution. Thus, AI can serve as a panacea for achieving sustainable quality assurance in tertiary institution in Nigeria. This study recommended that Nigerian government should maintain the application of artificial intelligence (AI) in its educational system to ensure that Nigerian education system meets up with global standard and to maintain quality assurance in tertiary institution in Nigeria.

Keywords: Artificial Intelligence (AI), Quality Assurance.

ASSESSING THE IMPACT OF DIGITAL LIBRARY SERVICES ON INFORMATION ACCESS AND USER SATISFACTION IN EDO STATE, NIGERIA

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Abstract:

This study investigates the role of digital library services in enhancing information access and user satisfaction in public and academic libraries across Edo State, Nigeria. Employing a mixed-methods approach, the research combines quantitative surveys (n=300) and qualitative interviews (n=20) with library users and librarians to evaluate the accessibility, usability, and effectiveness of digital library platforms. The study focuses on key digital library services, including e-books, online databases, and virtual reference systems, within the context of Edo State's diverse socio-economic and technological landscape. Findings reveal that while digital libraries significantly improve access to information, challenges such as inadequate ICT infrastructure, limited digital literacy, and erratic power supply hinder optimal utilization. User satisfaction is positively correlated with the availability of relevant digital resources and ease of platform navigation, though disparities exist between urban and rural library users. The study proposes targeted interventions to bridge access gaps, including enhanced digital literacy programs and infrastructure investments. These findings contribute to the growing literature on digital library adoption in developing regions and offer practical recommendations for library policymakers and practitioners in Edo State and similar contexts.

Keywords: Digital Libraries, Information Access, User Satisfaction, Library Services, Digital Literacy.

ENTREPRENUERSHIP AND SUSTAINABLE DEVELOPMENT

Exploring Entrepreneurship Education as a Catalyst for Sustainable Development In Kogi State.

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Abstract

Entrepreneurship education is increasingly recognized as a critical driver of economic growth and social transformation, particularly in developing regions like Kogi State, Nigeria. With a rapidly growing population and a high number of graduates entering the labor market annually, the demand for employment in both government and private sectors significantly exceeds available opportunities. The predominantly theoretical education acquired by these graduates primarily prepares them for paid employment, which is often scarce. This study examines the role of entrepreneurship education as a solution for sustainable development in Kogi State, with the objective of assessing its potential to reduce unemployment, alleviate poverty, and foster innovation. The research employs a descriptive analysis approach, utilizing secondary data from reputable journals, textbooks, newspapers, and online sources. Findings reveal that the large number of graduates entering the workforce annually contributes to rising unemployment due to the theoretical nature of their education, underscoring the need for entrepreneurship education to promote creativity, skills acquisition, and self-reliance. However, challenges such as inadequate funding, limited trained educators, and a lack of equipment hinder the effective implementation of entrepreneurship education. The study concludes that integrating an entrepreneurship-based curriculum across all educational levels, supported by government policies and stakeholder collaboration to create an enabling environment, can significantly enhance socio-economic development and sustainability in Kogi State.

Keywords: Entrepreneurship Education, Skills Acquisition, Sustainable Development, Unemployment, Kogi Statent.

Effect of Tier One Capital Components on Loan Portfolio of Deposit Money Banks In Nigeria.

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Abstract

The inadequacy of tier one capital components has been a recurring issue of concern in the Nigerian banking sector, potentially affecting the ability of deposit money banks to perform their traditional role of financial intermediation through loans and advances. Additionally, the impact of specific tier one capital components, such as paid-up share capital, retained earnings, statutory reserve, and share premium, on the loan portfolio of deposit money banks in Nigeria remains unclear hence, the study examines the effect of tier one capital components on loan portfolio of deposit money banks in Nigeria from 2015 to 2024. The independent variables of the study and proxies for tier one capital components are, paid-up share capital, retained earnings, statutory reserve and share premium while loans and advances is the dependent variable. A total of 23 deposit money banks were listed on the Nigeria Stock Exchange during the period, out of which 6 banks were sampled for the study. Secondary data were collected from the audited annual financial statements of the selected banks and analyzed using panel data regression analysis. Findings suggest that Paid Up-Share Capital and Retained Earnings have positive and significant effect on Loans and Advances. However, Statutory Reserve and Share Premium have positive but non-significant effect on Loans and Advances. The study recommends that Nigeria Deposit Money Bank should be adequately capitalized at all times in accordance with the Central Bank of Nigeria prudential guidelines to enable the bank to efficiently provide its traditional service of financial intermediation, while implementing retention policy that will enable them retain a sizable proportion of their earnings for future growth and expansion. The implication of the study is that strong bank capital components can enhance lending capacity, thereby contributing to industry development, economic growth and financial stability.

Socio-Pragmatic Study of Entrepreneurial Language in Social Media Marketing: a Paradigm Shift In Academic Discourse.

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Abstract

One cannot rule out the fact that the world has entered in the phase of global village. The social media is a formidable bridge connecting people of all works and space into a community of equality. Entrepreneurs have maximized the advertising space opportunity offered by social media to sell their goods and services. The innovative window opened through social media has made a conspicuous paradigm shift from the physical market to virtual market for entrepreneurs. The objective of this study is to investigate the rhetorics of social media entrepreneurs to determine how their choice of words, as it relates to their social environment affect their target audience; in other words, how they are used to persuade their target audience of their products. Halliday's Theory of Systemic Functional Linguistics (SFL) and Aristotelian Rhetoric is employed to guide the study. This study made use of both primary and secondary data. For the primary data, 20 short videos from Facebook were randomly selected, and; descriptive analysis carried out to draw the research inferences.

Keywords: Entrepreneurs, Social Media, Aristotelian rhetorics, Systemic Functional Linguistics (SFL)

Behavioral Economics in The Classroom: Teaching Students to Address Cognitive Biases in Financial Decision-Making

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Abstract

Cognitive biases significantly influence financial decision-making, often leading to suboptimal outcomes in personal and professional contexts. This study evaluates the effectiveness of incorporating behavioral economics principles into the classroom to teach secondary school students in Enugu State, Nigeria, how to recognize and mitigate cognitive biases in financial decision-making. A 10-week intervention was implemented with 180 students across two schools, integrating interactive lessons on biases such as anchoring, loss aversion, and overconfidence, alongside practical exercises like budgeting simulations and investment scenarios. A quasi-experimental design compared the intervention group to a control group receiving standard Economics Education. Quantitative results revealed a 41% improvement in bias identification accuracy and a 35% enhancement in rational decision-making skills among the intervention group. Qualitative feedback from students and Educators indicated increased confidence in financial planning and heightened awareness of psychological influences. Challenges included limited access to digital tools for simulations and the need for teacher training in Behavioral Economics. This study highlights the potential of Behavioral Economics Education to empower students with critical financial literacy skills, advocating for its integration into curricula while addressing resource and training barriers.

Keywords: behavioral economics, cognitive biases, financial decision-making, financial literacy.

A Review on the Role of Bookkeeping in Career Advancement.

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Abstract

Bookkeeping, often perceived as a fundamental financial skill, plays a pivotal role in individual career advancement across various professional fields. This review explores the significance of bookkeeping as not only a technical competency but also a strategic tool for personal and professional growth. The paper examines how proficiency in bookkeeping enhances financial literacy, decision-making capabilities, and organizational skills attributes highly valued in today's competitive job market. It further analyzes the relevance of bookkeeping in both entrepreneurial ventures and corporate settings, highlighting its influence on career mobility, business management, and leadership potential. The study draws on case studies and industry reports to demonstrate how individuals with strong bookkeeping knowledge are better positioned for roles in finance, accounting, administration, and business development. It also considers the growing demand for digital bookkeeping tools and the need for continuous skill development in an evolving technological landscape. The review concludes that integrating bookkeeping skills into professional development plans can significantly boost employability, job performance, and long-term career prospects.

Keywords: bookkeeping, financial literacy, career advancement, professional development

The Role of Effective Policy in Administrative Management in Nigeria's Higher Institutions

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Abstract

Effective policy frameworks are essential for robust administrative management in Nigeria's higher institutions, influencing academic quality, resource allocation, and institutional efficiency. This study examines the role of effective policy in enhancing administrative management within Nigerian universities, focusing on policy formulation, implementation, and its impact on operational outcomes. A mixed-methods approach was employed, involving a survey of 250 administrators and faculty across six Nigerian universities and semi-structured interviews with 22 participants. Findings reveal that 68% of respondents believe well-designed policies improve administrative efficiency, with clear policies on staff recruitment, financial management, and student welfare linked to better institutional performance. However, 62% cited challenges, including inconsistent policy enforcement, bureaucratic delays, and inadequate stakeholder engagement during policy formulation. Additional barriers include limited funding and resistance to change among staff. The study recommends participatory policy development, regular policy reviews, and capacity-building for administrators to ensure alignment with institutional goals. These insights underscore the critical role of effective policy in strengthening administrative management and suggest strategies for fostering sustainable governance in Nigeria's higher education sector.

Keywords: Effective Policy, Administrative Management, Nigerian Higher Institutions, Higher Education Governance

A Review on Impact of Structured Soft Loans on The Development and Sustainability of Small and Medium Enterprises (Smes) in Nigeria.

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Abstract

Small and Medium Enterprises (SMEs) are vital to Nigeria's economic growth, yet their development and sustainability are often constrained by limited access to finance. This study reviews the impact of structured soft loans characterized by low interest rates, flexible repayment terms, and targeted disbursement on the development and sustainability of SMEs in Nigeria. A systematic literature review was conducted, analyzing 35 peer-reviewed articles, government reports, and policy documents published between 2010 and 2024, complemented by a survey of 200 SME owners across three Nigerian states. Findings reveal that structured soft loans significantly enhance SME growth, with 72% of beneficiaries reporting increased capital investment, improved operational capacity, and job creation. Additionally, 65% noted improved sustainability through better cash flow management and resilience to economic shocks. However, challenges such as bureaucratic loan application processes, inadequate financial literacy, and limited outreach to rural SMEs hinder optimal impact. The study recommends streamlining loan disbursement mechanisms, integrating financial literacy training, and expanding soft loan programs to underserved regions. These insights highlight the transformative potential of structured soft loans in fostering SME development and economic sustainability in Nigeria.

Keywords: Structured Soft Loans, Small and Medium Enterprises, SME Development, Financial Access, Economic Growth.

The Role of Automobile Education in Sustainable Automotive Industry Development In Edo State, Nigeria

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Abstract:

Automobile education plays a crucial role in shaping the future of the automotive industry, particularly in regions striving for technological advancement and sustainable development. This study examines the impact of automobile education on the development of the automotive industry in Edo State, Nigeria, focusing on curriculum effectiveness, skill acquisition, and industry collaboration. Through a mixed-methods approach involving surveys, interviews, and observational studies, this research identifies key challenges in automobile education, including inadequate funding, outdated technology, and limited industry partnerships. The findings reveal that enhanced automobile education programs, supported by governmental policies and industry stakeholders, can significantly improve technical expertise, innovation, and employability of graduates. Additionally, the study emphasizes the importance of incorporating modern automotive technologies, such as electric vehicles and smart mobility solutions, into the curriculum to align with global industry trends. The study concludes with recommendations for policymakers, educators, and industry leaders on optimizing automobile education to foster sustainable automotive industry growth in Edo State.

Keywords: Automobile education, skill acquisition, automotive industry, sustainable development, curriculum effectiveness, industry collaboration.

Evaluating the Impact of Precision Agricultural Technologies on Crop Yield And Productivity: A Study of 30 Farms Across Three Geopolitical Zones In Nigeria.

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Abstract

Precision agricultural technologies, including drones and automated irrigation systems, are transforming farming practices by optimizing input use and enhancing productivity. This study evaluates their impact on crop yield and overall agricultural productivity in Nigeria through field data collection from 30 farms across three major agricultural zones (North-Central, South-West, and North-East Nigeria), case studies, and comparative analysis. Results indicate an average increase in crop yield by 30–45%, a 35% reduction in water and fertilizer usage, and a 25% decrease in labor costs. Specifically, drone-assisted monitoring improved pest and disease detection, leading to a 22% decrease in crop losses, while automated irrigation systems enhanced water efficiency, reducing over-irrigation and improving soil health. However, findings also highlight challenges, including high initial investment costs, lack of technical expertise, and infrastructural limitations, which hinder widespread adoption. To address these barriers, this paper recommends policy incentives, farmer training programs, and increased investment in agricultural technology to maximize the benefits of precision farming in Nigeria.

Keywords: Precision Agriculture, Drones, Automated Irrigation, Crop Yield, Nigeria, Agricultural Productivity.

Common Currency in West African Sub-Region: What Performance Statistics Reveals and The Role of Private Sector in Economic Stabilization.

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Abstract

It was in April 20, 2000, about 24 years ago, in Accra, Ghana, that the leaders of Six West African countries declared their intention to form a monetary union among the non-CFA franc countries of the region by January 2003, as a first step toward a wider monetary union that will include all the ECOWAS countries in 2004. The six (Nigeria, Ghana, Gambia, Guinea, Liberia and Sierra Leone) countries committed themselves to reducing central bank financing of budget deficits to 10 percent of the previous year's government revenue; reducing budget deficits to 4 percent of GDP by 2003; creating a Convergence Council to help coordinate macroeconomic policies; and setting up a common central bank. Their declaration states that, "Member States recognize the need for strong political commitment and undertake to pursue all such national policies as would facilitate the regional monetary integration process.This paper, using a historical approach, examined basic trends in reported data, tracing the performances of the nations for a period of 11 years (2012 to 2022) using the four primary convergence criteria according to the recommendations of 'Optimum Currency Areas theory' (Mundell, 1961), which was adopted by the promoters of the currency integration as the basis for the future prospects of the union. The performance data however, generally did not show evidence of a consistent trend towards the fulfillment of the adopted convergence criteria. The paper also noted the neglect of the private sector which can play major role in economic stability, through competition and recommended that economic managers of the region should convince their governments on the need to reduce public sector domination of the economy by channeling greater budgetary funds to the private sector, as is the tradition in advanced economies, for accelerated growth with stability.

Literature as A Tool for Motivating Innovative Entrepreneurship for A Sustainable Future: A Study of Chimamanda Adichie's Americanah

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Abstract

This paper explores how literature can serve as a catalyst for motivating innovation and entrepreneurship in the pursuit of a sustainable future. In light of rapid technological advances, economic uncertainties, and shifting consumer preferences, there is a growing need for creativity and adaptability in entrepreneurship—demands that extend across disciplines, including literature. Through a qualitative analysis of Chimamanda Ngozi Adichie's novel Americanah, this study underscores literature's capacity to foster critical thinking, risk-taking, and novel idea generation in business contexts. The text exemplifies how innovative storytelling can inspire entrepreneurial thinking and resilience. The paper concludes that entrepreneurial growth and sustainability hinge on the strategic application of creativity, innovation, and narrative frameworks.

Keywords: Nigerian Literature, innovation, creativity, entrepreneurship, sustainability.

Assessment of Fintech Payment Platform Service Quality In Savings and Loans Companies in Accra Metropolis

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Abstract

The rapid adoption of FinTech payment platforms by Savings and Loans Companies in Ghana has transformed financial service delivery. Yet, little is known about whether these digital services meet customer expectations. While service quality assessments are common in banking, limited research has compared customers' expectations and perceptions within the non-bank financial sector, creating a gap in understanding that is critical to enhancing user satisfaction and trust. This study addresses this gap by assessing the service quality of FinTech payment platforms in Savings and Loans Companies within the Accra Metropolis, Ghana, using the SERVQUAL model. The objective is to examine the gap between customers' expectations and their actual perceptions of service performance across five dimensions: Tangibles, Reliability, Responsiveness, Assurance, and Empathy. A quantitative research design was employed, using a structured questionnaire administered to 386 customers. Paired samples t-tests revealed statistically significant negative service quality gaps across all five dimensions, indicating that customer perceptions fell short of expectations. The largest gap was observed in responsiveness, followed by assurance and reliability. Paired correlations showed moderate to strong positive relationships between expectations and perceptions, while Cohen's d indicated small but practically meaningful effect sizes. The findings highlight critical shortfalls in the speed of customer support, system reliability, and trust-building features of FinTech payment platform services. Theoretically, the study extends the application of the SERVQUAL model to digital

financial services in non-bank institutions. Practically, it offers diagnostic insights for service improvement, while policy-wise, it supports the development of digital service quality benchmarks and customer protection regulations in Ghana's FinTech sector.

The Impact of Digital Marketing on Small-Scale Businesses in Nigeria.

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Abstract

Digital marketing has emerged as a transformative tool for small-scale businesses in Nigeria, enabling cost-effective market reach and customer engagement in a rapidly digitizing economy. This study investigates the impact of digital marketing on the growth, visibility, and sustainability of small-scale businesses in Nigeria, focusing on adoption patterns and outcomes. A mixed-methods approach was utilized, involving a survey of 250 small-scale business owners across four Nigerian states and semi-structured interviews with 20 participants. Findings reveal that 70% of businesses using digital marketing tools, such as social media, email campaigns, and search engine optimization, reported a 40% average increase in customer acquisition and 35% revenue growth. Additionally, 65% noted enhanced brand visibility and customer loyalty. Key adoption drivers include affordability, ease of use, and access to mobile internet. However, challenges such as unreliable internet connectivity (cited by 60%), limited digital skills, and high data costs hinder optimal utilization. The study recommends tailored digital marketing training, subsidized internet access, and public-private partnerships to bridge infrastructure gaps. These insights highlight digital marketing's pivotal role in empowering small-scale businesses and fostering economic resilience in Nigeria.

Keywords: Digital Marketing, Small-Scale Businesses, Customer Acquisition, Brand Visibility, Digital Skills.

EDUCATION AND PEDAGOGY

Student Preferences for Online Interaction Platforms in Blended Learning: A Mixed-Methods Study

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Abstract

As higher education increasingly adopts blended learning, understanding students' preferences for online interaction platforms becomes critical for effective course delivery and engagement. This study investigates the platforms undergraduate students prefer for academic communication and explores the underlying reasons for these choices. Data were collected from 37 students enrolled in two summer courses at a Ghanaian university using a structured questionnaire consisting of both closed and open-ended items. Quantitative results revealed a strong preference for instant messaging platforms such as WhatsApp and Telegram over institutional learning management systems. Qualitative content analysis of the open-ended responses identified five key factors influencing platform preference: convenience and familiarity, ease of use, accessibility, popularity among peers, and support for real-time interactions. These findings highlight a significant mismatch between students' communication habits and institutional platform offerings. The study highlights the importance of aligning digital learning strategies with students lived digital experiences to enhance interaction, collaboration, and learner satisfaction in blended learning environments.

Keywords: blended learning, student preferences, online platforms, WhatsApp, LMS, qualitative content analysis, digital communication

Crisis Leadership in Education: Evaluating Post-Pandemic Management Strategies for Teacher Retention and Student Well-Being in Enugu State, Nigeria

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Abstract

The COVID-19 pandemic severely disrupted Nigeria's educational system, exacerbating pre-existing challenges in teacher retention and student mental health, particularly in Enugu State. This study evaluates the effectiveness of post-pandemic crisis leadership strategies adopted by secondary schools in Enugu State to address these issues. Using a mixed-methods approach, data were collected from 25 school administrators and 150 teachers across urban and rural schools through questionnaires, in-depth interviews, and document analysis. Findings reveal that schools implementing participatory leadership, peer-support networks, and mental health awareness programs experienced a 19% improvement in teacher retention compared to schools with rigid hierarchical structures. Qualitative data highlighted that regular staff welfare initiatives and community-engagement strategies were critical in reducing burnout. Regarding student well-being, institutions incorporating culturally adapted psychosocial support and hybrid learning flexibility reported a 26% decrease in absenteeism and improved emotional resilience. However, significant challenges persisted, including inadequate funding (reported by 68% of schools) and insufficient training in crisis management (reported by 57% of administrators). The study concludes that sustainable recovery in Enugu State requires context-specific leadership models, increased government investment, and policy integration of mental health support in school governance frameworks.

Keywords: Crisis leadership, teacher retention, student well-being, post-pandemic education, participatory leadership, psychosocial support, educational policy.

The Covid-19 Pandemic's Impact on Traditional and Modern (Online) Basic School Learning: A Quantitative Case Study in Ghana

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Abstract

The COVID-19 pandemic drastically altered the landscape of basic education in Ghana, prompting an urgent shift from traditional classroom learning to remote and blended learning modalities. In response, the Ministry of Education (MoE) and the Ghana Education Service (GES) implemented emergency policies to facilitate online learning and safeguard educational continuity, particularly in urban areas such as the Korle Klottey Constituency in Accra. This quantitative case study investigates the preparedness of basic schools for remote instruction, the challenges encountered by stakeholders, and the effectiveness of post-pandemic interventions in supporting blended learning models. Data were collected through structured questionnaires administered to 82 participants comprising students, parents, teachers, and policymakers. The study was underpinned by the behavioral theory, resilience theory, and digital divide theory, which provided a lens to evaluate stakeholder responses, systemic adaptability, and technology-related inequities. Key findings reveal significant gaps in digital infrastructure, internet accessibility, and stakeholder digital literacy, as well as inconsistencies in policy implementation and limited stakeholder involvement in decision-making. While policymakers perceived the education system to be relatively prepared, teachers, parents, and students expressed contrary experiences, citing major technological, pedagogical, and psychological challenges. Despite these limitations, the study found emerging resilience in the education system and identified opportunities to institutionalize blended learning. The study concludes by recommending targeted investments in digital infrastructure, stakeholder training, and participatory policy design to build a more inclusive and adaptive basic education framework in Ghana's post-pandemic context.

Psychological Factors Influencing Learning Outcomes in Secondary Schools in Edo State, Nigeria

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Abstract:

Educational psychology plays a vital role in understanding and enhancing student learning outcomes. This study investigates the psychological factors affecting academic performance among secondary school students in Edo State, Nigeria. Using a mixed-methods approach, the research examines key variables such as motivation, self-efficacy, cognitive development, and socio-emotional influences. Data collection includes structured questionnaires, interviews with educators, and observational studies in selected schools. Findings reveal that intrinsic motivation, teacher-student relationships, and parental involvement significantly shape students' learning outcomes. Additionally, the study highlights the impact of school environment and psychological interventions in improving academic performance. The results suggest that implementing tailored psychological strategies, such as cognitive-based learning methods and emotional support systems, can enhance student engagement and overall educational achievement. The study concludes with recommendations for educators, policymakers, and stakeholders to integrate psychological principles into instructional design for optimal student development.

Keywords: learning outcomes, motivation, self-efficacy, cognitive development, socioemotional
influences.

Enhancing Curriculum Implementation Through Contextualized Pedagogical Strategies in Edo State Secondary Schools

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Abstract:

This study investigates the efficacy of contextualized pedagogical strategies in enhancing curriculum implementation within secondary schools in Edo State, Nigeria. Despite national curriculum frameworks, challenges such as resource constraints, cultural misalignment, and teacher preparedness hinder effective delivery. Drawing on a mixed-methods approach, the research engaged 150 teachers and 300 students across 10 public and private secondary schools in Edo State. Quantitative data from surveys assessed teacher perceptions of curriculum relevance and implementation barriers, while qualitative interviews explored student experiences and community influences on learning. Findings reveal that integrating local cultural contexts, indigenous knowledge, and community-based resources into teaching practices significantly improves student engagement and curriculum comprehension. However, systemic issues, including inadequate training and infrastructure, limit scalability. The study proposes a localized teacher training model emphasizing culturally responsive pedagogy to bridge curriculum intent and classroom practice. These insights contribute to curriculum studies by highlighting the importance of place-based education in addressing implementation gaps in diverse educational settings.

Keywords: Curriculum Implementation, Contextualized Pedagogy, Culturally Responsive Teaching, Place-Based Education.

Ai-Optimized Virtual Labs for Chemistry Education Students In Enugu State College Of Education Technical

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Abstract

The integration of artificial intelligence (AI) into virtual laboratory environments has revolutionized experiential learning in science education, particularly in resourcelimited settings. This study investigates the efficacy of AI-optimized virtual labs in enhancing chemistry education for students at Enugu State College of Education Technical, Nigeria. A custom AI-driven virtual lab platform was implemented, enabling 180 chemistry students to conduct simulated experiments on topics such as chemical reactions, titration, and molecular modeling. The AI system provided real time feedback, adaptive difficulty adjustments, and personalized learning pathways based on students' performance and engagement levels. Using a quasi-experimental design, the study compared learning outcomes between the AI-optimized virtual lab group and a control group using traditional teaching methods. Results showed a 42% improvement in conceptual understanding and a 36% increase in practical skills retention in the virtual lab group. Qualitative data from student surveys indicated high satisfaction with the platform's interactivity and accessibility, though challenges like limited device access and internet connectivity were noted. This research highlights the potential of AI-optimized virtual labs to address infrastructure gaps in chemistry education in Enugu, offering a scalable, cost-effective solution while emphasizing the need for improved technological access.

Keywords: artificial intelligence, virtual labs, chemistry education, experiential learning, adaptive feedback, skill retention.

Inquiry-Based Learning Through Low-Cost Physics Experiments: Fostering Critical Thinking in Pre-Service Teachers

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Abstract

This study explores the effectiveness of inquiry-based learning (IBL) through the application of low-cost physics experiments to foster critical thinking in pre-service teachers within Enugu State, Nigeria. The study adopts a mixed-method approach, combining quantitative and qualitative data collection techniques, to evaluate the impact of hands-on, inquiry-oriented physics activities on the critical thinking abilities and teaching preparedness of pre-service teachers. By leveraging locally available and affordable materials, the experiments were designed to enable educators to actively engage students in problem-solving, hypothesis testing, and reflective learning.

Findings reveal that integrating IBL strategies into teacher education programs significantly improves pre-service teachers' ability to analyze, interpret, and apply scientific concepts, thereby equipping them with practical skills for fostering active learning in secondary schools. The study highlights the potential of low-cost experimental setups to overcome resource constraints in educational institutions while promoting quality science education. Implications for curriculum development and teacher training programs are discussed, with recommendations for scaling and institutionalizing such initiatives in resource-limited settings.

Keywords: Inquiry-Based Learning, Low-Cost Physics Experiments, Critical Thinking, Pre-Service Teachers, Teacher Education, Science Education

Addressing "Chemophobia" in General Chemistry: Evaluating the Role of Context-Based Learning

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Abstract

Public apprehension toward synthetic chemicals, termed "chemophobia," poses a significant challenge in science education, often stemming from misinformation and a lack of contextual understanding. This study evaluates the effectiveness of contextbased learning (CBL) in mitigating chemophobia among general chemistry students by integrating real-world applications and socioscientific discussions into the curriculum. A quasi-experimental design was employed, comparing pre- and postintervention surveys of student attitudes (n=200) across control (traditional instruction) and experimental (CBL-enhanced) groups at a public university. The CBL module emphasized case studies on pharmaceuticals, food additives, and environmental pollutants, linking chemical principles to societal decision-making. Results showed a 27% reduction in negative perceptions of synthetic chemicals ($p < 0.05$) and improved ability to evaluate chemical risks rationally (effect size $d = 0.63$) in the CBL group. Qualitative analysis of open-ended responses revealed increased appreciation for risk benefit analysis and reduced absolutist views (e.g., "chemical-free" misconceptions).

However, 22% of students retained distrust of regulatory systems, highlighting lingering institutional skepticism. These findings advocate for CBL as a tool to bridge the gap between chemical literacy and public discourse, suggesting that addressing chemophobia requires both pedagogical innovation and explicit engagement with societal trust gaps in science.

Keywords: Chemophobia, context-based learning, chemical education, risk perception, sociocentric issues, public understanding of science.

Assessing the Impact of Digital Accounting Systems on Financial Reporting Accuracy in Small and Medium Enterprises in Edo State, Nigeria

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Abstract:

This study investigates the influence of digital accounting systems on the accuracy of financial reporting among small and medium enterprises (SMEs) in Edo State, Nigeria. Despite the global shift toward digitalization, many SMEs in developing regions face challenges in adopting and optimizing digital accounting tools, leading to persistent errors in financial reporting. Using a mixed-methods approach, data were collected from 150 SME owners and accountants in Edo State through structured questionnaires and semi-structured interviews. The study used descriptive statistics and regression analysis to evaluate the relationship between the adoption of digital accounting, user competency, and the accuracy of financial reporting. Findings reveal that SMEs utilizing digital accounting systems, such as cloud-based software, exhibit a 35% reduction in reporting errors compared to those relying on manual processes. However, inadequate training and high implementation costs were identified as significant barriers to adoption. The study underscores the need for targeted capacity-building programs and cost-effective digital solutions to enhance financial transparency and compliance in Edo State's SME sector. These results contribute to the growing literature on accounting technology adoption in developing economies and provide actionable insights for policymakers and business support agencies.

Keywords: DAS, FRA, SMEs, Accounting Technology, Cloud-Based Software.

Enhancing Electrical Electronics Education Through Project-Based Learning in Edo State, Nigeria

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Abstract:

This study investigates the efficacy of project-based learning (PBL) in improving student engagement, technical skills acquisition, and academic performance in Electrical Electronics Education within secondary schools in Edo State, Nigeria. The research addresses the gap in practical, hands-on training in electrical and electronics curricula, which often prioritizes theoretical knowledge over applied skills critical for industry readiness. A mixed-methods approach was employed, involving 150 students and 20 educators across five selected secondary schools in Edo State. The intervention group participated in a 12-week PBL program, designing and constructing functional electrical circuits, while the control group followed the conventional lecture-based curriculum. Quantitative data, collected through pre- and post-tests, revealed a statistically significant improvement in the PBL group's academic scores ($p < 0.05$) and technical proficiency in circuit design and troubleshooting. Qualitative findings from semi-structured interviews highlighted increased student motivation, collaboration, and problem-solving skills. Educators reported enhanced teaching experiences but noted challenges such as resource limitations and time constraints. The study underscores PBL's potential to bridge the theory-practice gap in Electrical Electronics Education, particularly in resource-constrained settings like Edo State. Recommendations include integrating PBL into the national curriculum, providing teacher training, and addressing infrastructural deficits to sustain implementation. This research contributes to the discourse on innovative pedagogies for technical education in developing contexts.

Keywords: EEE, PBL, Technical Skills, Student Engagement.

Exploring the Impact of Indigenous Storytelling on Emotional Regulation in Early Childhood Care Education: A Case Study in Edo State, Nigeria

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Abstract:

This study investigates the novel integration of indigenous storytelling as a pedagogical tool for fostering emotional regulation among preschool-aged children in Early Childhood Care Education (ECCE) settings in Edo State, Nigeria. Despite the growing emphasis on socio-emotional development in early education, the potential of culturally rooted storytelling, drawn from Edo oral traditions, remains unexplored in ECCE research. This qualitative study employs a case study design, involving 20 ECCE educators and 60 children aged 3–5 years across four rural and urban preschools in Edo State. Data were collected through semi-structured interviews, classroom observations, and focus group discussions with educators trained to incorporate indigenous stories into their curricula. Findings reveal that storytelling rooted in Edo cultural narratives significantly enhances children's ability to identify, express, and manage emotions, while fostering a sense of cultural identity and belonging. Educators reported improved classroom engagement and reduced behavioral challenges, attributing these outcomes to the relatable and value-laden content of the stories. The study underscores the need for culturally responsive pedagogies in ECCE and recommends the inclusion of indigenous storytelling in teacher training programs. This research fills a critical gap in ECCE literature by highlighting a culturally specific, underexplored approach to emotional regulation, with implications for policy and practice in Nigeria and beyond.

Keywords: Indigenous storytelling, emotional regulation, ECCE, culturally responsive pedagogy.

Lightweight Deep Federated Learning for Polyethylene Terephthalate (Pet) Plastic Waste Detection at Landfill Sites.

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Abstract

The accumulation of polyethylene terephthalate (PET) plastic waste in landfill sites brings about significant environmental challenges as a result of its persistence, high volume, and limited biodegradability. Accurate and efficient detection of PET waste is essential for improving recycling processes and supporting sustainable waste management. However, conventional deep learning approaches for object detection often depend on centralized datasets, which are impractical for multi-site landfills due to data privacy concerns, heterogeneity, and communication constraints. This study proposes a lightweight deep federated learning framework for PET plastic waste detection in landfill environments. The methodology incorporates a YOLO-based lightweight object detection architecture with the Federated Averaging (FedAvg) algorithm, enabling decentralized model training across multiple landfill sites without sharing raw image data. Public datasets, including PlastOPol and RealWaste, supplemented by custom drone-captured images, were used for model training and evaluation. Model optimization techniques such as pruning and quantization were applied to reduce computational complexity, making the framework deployable on edge devices (e.g., NVIDIA Jetson Nano). Experimental results demonstrate that the proposed federated model achieves competitive detection accuracy (mean Average Precision [mAP] > 85%) with significantly reduced model size and inference time compared to traditional centralized models. The federated framework also showed improved generalization across diverse landfill conditions while preserving data privacy. This research contributes to the development of scalable, privacy-preserving, and resource-efficient solutions for plastic waste detection and offers insights for integrating artificial intelligence into sustainable landfill management systems.

Keywords: Federated Learning, Lightweight Deep Learning, YOLO, PET Plastic Detection, Landfill Waste Management, Edge Computing.

Enhancing Educational Assessment Through Formative Evaluation Practices in Secondary Schools: A Case Study of Edo State, Nigeria

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Abstract: This study investigates the impact of formative evaluation practices on student academic performance and teacher efficacy in secondary schools within Edo State, Nigeria. Utilizing a mixed-methods research design, the study explores how measurement and evaluation strategies, specifically formative assessment techniques, influence learning outcomes and instructional quality. Data were collected from 300 students and 50 teachers across 10 public and private secondary schools in Edo State through surveys, classroom observations, and semi-structured interviews. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data underwent thematic analysis. Findings reveal that consistent use of formative evaluation, including feedback mechanisms, self-assessment, and peer assessment, significantly enhances student engagement, academic achievement, and critical thinking skills. Teachers reported improved pedagogical confidence and adaptability when employing formative assessment tools. However, challenges such as inadequate training, resource constraints, and large class sizes hinder optimal implementation. The study recommends targeted professional development for educators, integration of technology in assessment processes, and policy reforms to strengthen measurement and evaluation frameworks in Edo State's education system. These findings contribute to the global discourse on effective assessment practices and provide actionable insights for stakeholders in educational evaluation.

Keywords: Formative evaluation, measurement and evaluation, academic performance, teacher efficacy, formative assessment.

Enhancing Mathematical Problem-Solving Skills Through Collaborative Learning Strategies in Secondary Schools: A Case Study in Edo State, Nigeria

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Abstract:

This study investigates the impact of collaborative learning strategies on enhancing mathematical problem-solving skills among secondary school students in Edo State, Nigeria. Utilizing a mixed-methods approach, the research involved 120 Senior Secondary 2 students across four public schools in Benin City, selected through stratified random sampling. The experimental group engaged in collaborative learning activities, including peer tutoring and group problem-solving tasks, while the control group followed traditional teacher-centered instruction. Pre- and post-tests, semi-structured interviews, and classroom observations were employed to assess students' problem-solving abilities and perceptions of the learning process. Results revealed a statistically significant improvement in the experimental group's problem-solving skills ($p < 0.05$), with a mean score increase of 28% compared to 12% in the control group. Qualitative findings highlighted increased student engagement, improved communication, and greater confidence in tackling complex mathematical problems. The study underscores the efficacy of collaborative learning in fostering critical thinking and problem-solving skills within the context of mathematics education. Recommendations include integrating collaborative strategies into the mathematics curriculum and providing teacher training to facilitate effective implementation in Edo State's educational system. This research contributes to the growing body of evidence supporting student-centered pedagogies in mathematics education, particularly in resource-constrained settings.

Keywords: Collaborative Learning, Mathematical Problem-Solving, Mathematics Education, Student-Centered Pedagogy, Critical Thinking

The Impact of Digitalization on Library Services and Information Access in Edo State, Nigeria

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Abstract:

The digital revolution has transformed library and information science, reshaping how information is stored, accessed, and utilized. This study explores the impact of digitalization on library services and information access in Edo State, Nigeria, focusing on integrating digital resources, user adaptability, and institutional preparedness. Employing a mixed-methods research approach, data collection includes surveys of library users, interviews with librarians, and an assessment of digital infrastructure in selected academic and public libraries. Findings reveal that while digitalization enhances accessibility, efficiency, and resource sharing, challenges such as inadequate funding, digital literacy gaps, and infrastructural limitations hinder optimal implementation. Additionally, the study highlights the role of information technology in bridging knowledge gaps and improving research capabilities. The research concludes by recommending strategies for policymakers, library administrators, and educators to foster a more inclusive, technologically advanced library system in Edo State.

Keywords: Library and information science, digitalization, information access, digital resources, academic libraries.

Integrating Climate Change Biology into Secondary School Curricula: Assessing Student Awareness and Misconceptions

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Abstract

Climate change is a critical global challenge, yet awareness and understanding among secondary school students remain limited, particularly in regions like Enugu State, Nigeria. This study assessed student awareness and misconceptions about climate change biology and evaluated the extent of its integration into the secondary school curriculum. A mixed-methods approach was employed, combining surveys (n=350) and focus group discussions (n=5 schools) with students and teachers across urban and rural schools in Enugu State. Results revealed moderate awareness (58%) of climate change concepts but significant misconceptions, particularly regarding causes (e.g., overemphasis on natural factors over anthropogenic drivers) and impacts (e.g., limited understanding of biodiversity effects). Only 32% of students reported structured classroom coverage of climate change biology, with disparities between public and private schools. Teachers identified inadequate training (72%) and curricular gaps (65%) as key barriers. The findings underscore the urgent need for curriculum reform to integrate robust, evidence-based climate change education, coupled with teacher capacity building. Recommendations include localized teaching resources, participatory learning approaches, and policy advocacy for standardized climate literacy frameworks in Nigerian secondary education.

Keywords: Climate change education, secondary school curriculum, student awareness, misconceptions, biology education, climate literacy.

The Impact of Online Teaching and Learning of Technical and Vocational Education

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Abstract

The rapid shift to online teaching and learning has transformed educational delivery worldwide, yet its impact on technical and vocational education (TVE) remains underexplored, particularly in developing contexts like Nigeria. This study investigates the efficacy, challenges, and perceptions of online teaching and learning in TVE programs among 236 participants in Enugu, Nigeria, comprising 150 students, 60 instructors, and 26 administrators. A mixed-methods approach was employed, utilizing surveys and semi-structured interviews conducted between June and November 2024. Quantitative data revealed that 68% of students (n=102) reported improved access to learning materials online, while 54% (n=81) experienced difficulties due to unreliable internet connectivity. Instructors noted a 62% satisfaction rate (n=37) with online platforms for theoretical lessons, but only 28% (n=17) found them effective for practical skill demonstrations. Administrators highlighted a 15% increase in enrollment attributed to online flexibility, yet 73% (n=19) cited funding constraints for technological upgrades. Qualitative findings underscored recurring themes of digital literacy gaps, equipment shortages, and the need for hybrid models to balance virtual and hands-on training. Statistical analysis using chi-square tests showed a significant association between internet access quality and student performance ($\chi^2 = 12.45$, $p < 0.05$). These results suggest that while online learning enhances accessibility in TVE, its success in Enugu hinges on addressing infrastructural deficits and adapting curricula for practical competencies. The study recommends targeted investments in internet infrastructure and instructor training to optimize online TVE delivery in resource-constrained settings.

Keywords: Online Learning, Technical and Vocational Education (TVE), Digital Literacy, Internet Connectivity, Hybrid Model.

Gamified Virtual Reality Environments for Collaborative Learning among Nursing Students in Enugu State Nigeria

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Abstract

Gamified virtual reality (VR) environments offer innovative opportunities for collaborative learning by fostering engagement and teamwork in immersive settings. This study explores the impact of gamified VR platforms on collaborative learning among nursing students at three institutions in Enugu State, Nigeria. A custom VR environment, incorporating gamified elements such as points, leaderboards, and scenario-based challenges, was designed to simulate clinical scenarios like patient triage, emergency response, and surgical assistance. A total of 160 nursing students participated in a six-month intervention, working in teams within the VR platform. A mixed-methods approach assessed outcomes, with quantitative data showing a 39% improvement in collaborative problem-solving skills and a 47% increase in clinical decision-making accuracy compared to a control group using traditional methods. Qualitative feedback highlighted enhanced motivation, communication, and peer learning, attributed to the gamified and immersive nature of the VR environment. Challenges included limited access to VR hardware, high initial costs, and the need for faculty training. This study demonstrates the potential of gamified VR to transform nursing education in Enugu by promoting collaborative competencies, while underscoring the necessity for infrastructure support and cost-effective scaling strategies.

Keywords: gamified virtual reality, collaborative learning, nursing education, clinical simulation.

Sustainable Food Systems Education: Integrating Urban Farming into Home Economics Curricula

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Abstract

As global urbanization accelerates, sustainable food systems education is vital for fostering environmental stewardship and food security. This study examines the integration of urban farming into the Home Economics curricula to enhance students' knowledge and practical skills in sustainable food production. Conducted at three secondary schools in Enugu State, Nigeria, the intervention involved 200 students participating in a 12-week program combining theoretical lessons on urban agriculture with hands-on activities, including vertical gardening, hydroponics, and organic composting. A quasi-experimental design assessed outcomes, comparing the intervention group to a control group following a standard Home Economics curriculum. Quantitative results showed a 45% increase in students' understanding of sustainable food systems and a 38% improvement in practical farming skills. Qualitative feedback from students and teachers highlighted heightened environmental awareness and enthusiasm for local food production. Challenges included limited access to farming materials, initial resistance to curriculum changes, and the need for teacher training. This study underscores the potential of embedding urban farming in Home Economics education to empower students as agents of sustainable change, while emphasizing the need for resource support and scalable curriculum frameworks.

Keywords: sustainable food systems, urban farming, food security, practical skills, curriculum integration.

ENVIRONMENTAL SCIENCE & HEALTH

Assessing the Interplay of Environmental, Social, and Technological Factors on Sustainable Agricultural Practices in Edo State, Nigeria

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Abstract:

This study investigates the integrated dynamics of environmental, social, and technological factors influencing sustainable agricultural practices in Edo State, Nigeria, a region characterized by diverse agroecological zones and socio-economic complexities. Employing a mixed-methods approach, the research combines quantitative data from soil quality assessments, climate variability analyses, and technology adoption surveys with qualitative insights from farmer interviews and community focus groups. The study area, Edo State, serves as a critical case due to its rich biodiversity, rapid urbanization, and vulnerability to climate change impacts. Findings reveal that soil degradation and erratic rainfall patterns significantly constrain agricultural productivity, while limited access to modern farming technologies exacerbates inefficiencies. Socially, cultural practices and gender roles shape technology adoption, with women farmers facing disproportionate barriers. However, community-driven initiatives and mobile-based agricultural extension services show promise in enhancing resilience. The study proposes an integrated framework for policymakers, combining precision agriculture, capacity-building programs, and inclusive governance to promote sustainability. This research contributes to Integrated Science by demonstrating how interdisciplinary approaches can address complex socio-environmental challenges in tropical agricultural systems.

Keywords: Sustainable agriculture, environmental degradation, technology adoption, climate change.

The Effects of Bio-Filler Composite Materials And its Coating for Fire Resistance On Plywood

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Abstract:

There's a growing need for building materials that go beyond eco-friendly but also resistant to fire, and that's why we're looking into bio-filler composite materials for use as coatings on plywood. This study dives into how adding bio-based fillers—like agricultural leftovers, natural fibers, or mineral additives—into polymer mixes can boost the fire resistance of plywood. We took a close look at the composite coatings, testing their thermal stability, flame resistance, and mechanical strength using various methods like Thermo-Gravimetric Analysis (TGA), cone calorimetry, and flammability tests. What we found is pretty exciting: these bio-filler composites really up the ante on fire resistance by cutting down on Heat Release Rates (HRR), smoke production, and how fast flames spread compared to regular plywood. Plus, the coatings stick well and last while also being better for the environment. So, our findings suggest these bio-filler composite coatings are a great, eco-friendly way to improve fire safety in plywood for construction projects, particularly in buildings. The new mechanical and chemical properties really boost fire resistance too. In fact, the results show that this fire resistance holds up even at really high temperatures. All in all, our research emphasizes the significance of reinforcing plywood and other wood types used in construction, especially for buildings. We suggest that construction firms should definitely look into how these materials can enhance their building materials.

Keywords: Bio-filler composites, fire resistance, plywood, flame retardant, sustainable coatings, thermal stability, building construction.

Assessing the Potential of Locally Sourced Clay Minerals in Enugu State for rhe Synthesis of Zeolites for Water Purification

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Abstract

This study evaluates the potential of locally sourced clay minerals from Enugu State, Nigeria, for synthesizing zeolites applicable in water purification. Kaolinite-rich clay samples were collected from deposits in Nsukka, Obollo-Afor, and Emene, characterized using X-ray diffraction (XRD), X-ray fluorescence (XRF), and scanning electron microscopy (SEM) to determine their mineralogical and chemical compositions. The clays, primarily composed of kaolinite (60–75%) with minor quartz and illite, exhibited high silica (SiO_2: 45–50%) and alumina (Al_2O_3: 30–35%)

contents, suitable for zeolite synthesis. Zeolites were synthesized via hydrothermal treatment using sodium hydroxide activation at optimized conditions (100°C, 24 hours). The resulting zeolites, identified as zeolite A and X through XRD, demonstrated high cation exchange capacities (CEC: 180–220 meq/100g) and surface areas (BET: 300–450 m²/g). Batch adsorption tests assessed their efficacy in removing heavy metals (Pb^{2+}, Cd^{2+}) and organic pollutants (methylene blue) from contaminated water, achieving removal efficiencies of 85–95% under optimal conditions (pH 6, 25°C, 2 g/L dosage). The findings indicate that Enugu State's clay minerals are viable precursors for cost-effective zeolite production, offering a sustainable solution for water purification in resource-constrained regions. Further scalability studies are recommended to enhance practical implementation.

Recent advances in Sol-Gel SYNTHESIS of MgZr$_{4(1-x)}$ M$_{4x}$P$_6$O$_{24}$ (x = 0, 1; M = Hf) Electroceramic Electrolytes for Electrochemical Devices

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Abstract

The potential solid electrolytes, MgZr$_4$P$_6$O$_{24}$ and MgHf$_4$P$_6$O$_{24}$ were prepared using modified novel sol-gel method. Structural and electrical properties of the solid electrolytes were determined. TGA-DSC analyses indicated that the pure dried xerogel powders, when calcined at 900 ^{o}C converts to pure single phase MgZr$_4$P$_6$O$_{24}$ and MgHf$_4$P$_6$O$_{24}$ nanopowders with good crystallinity. Pellets of 13 mm diameter and 3.8 mm thickness made by uniaxial compression were respectively sintered at 1300 ^{o}C. Powder XRD analyses indicated that crystalline phase of MgZr$_4$P$_6$O$_{24}$ and MgHf$_4$P$_6$O$_{24}$ nanoparticles are monoclinic, with crystallite size of approx. 39 mm and 42 mm, respectively. The sintered pellets were stable in the temperature range from 1000 ^{o}C to 1300 ^{o}C, with MgHf$_4$P$_6$O$_{24}$ solid electrolyte not showing any trace of coexistent second phase at higher temperatures. Relative density analyses of MgZr$_4$P$_6$O$_{24}$ and MgHf$_4$P$_6$O$_{24}$ pellets yield optimum density of approx. 99% and 98% at 1300 ^{o}C, respectively. Using impedance spectroscopy, the bulk ionic conductivity of the platinum-cured MgZr$_4$P$_6$O$_{24}$ and MgHf$_4$P$_6$O$_{24}$ pellets were determined as 7.23 x 10^{-3} Scm^{-1} at 725 ^{o}C and 4.52 x 10^{-4} Scm^{-1} at 747 ^{o}C, respectively. Activation energy of the MgZr$_4$P$_6$O$_{24}$ (E$_a$ = 0.84±0.04eV) and MgHf$_4$P$_6$O$_{24}$ (E$_a$ = 0.74±0.02eV) solid electrolytes, depicting MgZr$_4$P$_6$O$_{24}$ solid electrolyte as possessing better Mg^{2+}-ion conducting mobile species at high temperatures. However, both solid electrolytes find suitable applications in electrochemical devices.

Comparative Study of Microbial Bioremediation in Hydrocarbon Polluted Soil.

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Abstract

The protection of environmental well-being requires effective cleanup approaches because petroleum leakages from spills and industrial waste products negatively affect underground water resources together with soil conditions and habitat structures. The environmentally preferable cleanup procedure utilizes microbial functions which functions well in both aerated systems as well as reducing systems existing in oxygen-free areas during bioremediation. Researchers combine studies about decomposing microorganisms with measurement of component responses in order to develop innovative soil restoration approaches that maintain ecological integrity. Discharged hydrocarbon-breaking microorganisms was tracked throughout a span of 90 days at the study area. This study examined essential parameters which included Total Petroleum Hydrocarbon (TPH) degradation rates and microbial diversity along with enzymatic activity and byproduct formation using combination methods of GC and 16S rRNA sequencing and spectrophotometric assays. The aerobic process allowed indicated a higher TPH reduction rate of 85% because oxygen-dependent monooxygenases and dioxygenases enzymes operate better in aerobic environments. Bacteria that reduce sulfate or nitrate used the oxygen-empty environment to break down contaminants into minimal microbial matter and the predominant end products were methane and fatty acids. Study results showed *Pseudomonas* and *Bacillus* species ruled the aerobic degradation pathway during simultaneous existence with *Desulfovibrio* and *Clostridium* species dominating the anaerobic conditions. Through this research results, it became clear that aerobic bioremediation reaches rapid complete breakdown while anaerobic degradation exceled at treating substance degradation in oxygen-free systems. Studies of identified communities result in optimized bioremediation techniques for different contaminated sites which advances both

environmental care and restores soil health.

Radioactivity Measurements of Soil Samples from the Excavation Sites at Onyeama Hill Enugu, Enugu State, Nigeria

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Abstract

The use of materials from the earth's crust for building and other purposes such paint making is a source of concern due to natural radiations emanating from them. This exposes human dwellers to worrisome levels of radiation and cause a lot of health risks when the permissible limit is exceeded. This study assessed the radioactivity level of the Onyeama hill excavation sites by measuring the activity concentrations of ^{40}K, ^{226}Ra and ^{232}Th in soils sourced from six excavation sites at Onyeama hill, using gamma – ray spectrometry with Sodium Iodide (NaITl) detector. The soil samples were randomly collected at six excavation locations and taken to the laboratory for preparations and measurements. Results showed average activity concentrations in Bq/kg ranges from (125.08 ± 5.8 – 158.4 ± 5.8 Bq/kg) for ^{40}K, (18.9 ± 3.4 - 39.3 ± 3.3 Bq/kg) for ^{226}Ra and (22.1 ± 1.7 – 36.8 ± 1.6 Bq/kg) for ^{232}Th, with mean radioactivity level of less than unity, showing that soils from the sites are safe when used for building construction and other purposes.

Keywords: Radioactivity levels, Excavation soil, Gamma ray

Human Performance Degradation in Security Operations: A Study of Stress and Burnout among Nigerian Security Personnel

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Abstract

This study investigates the phenomenon of human performance degradation in security operations, with a specific focus on stress and burnout among Nigerian security personnel. In the face of rising internal security challenges—including terrorism, banditry, and civil unrest—security operatives are increasingly subjected to prolonged exposure to high-stakes environments, often with limited institutional support. This research employs a multidisciplinary lens, drawing from organizational psychology, security studies, and occupational health to explore the physiological, emotional, and cognitive impacts of operational stress. Utilizing a mixed-methods approach, data were collected through structured questionnaires, in-depth interviews, and field observations across multiple security agencies in Nigeria. Findings reveal a high prevalence of chronic stress, emotional exhaustion, and depersonalization, all of which contribute significantly to diminished operational effectiveness and compromised decision-making. The study further highlights systemic issues such as inadequate welfare provisions, erratic work schedules, and insufficient psychological support systems. The paper calls for a comprehensive policy framework that integrates stress management training, regular mental health assessments, and institutional reforms aimed at enhancing resilience and occupational well-being among security personnel. By situating Nigeria's security challenges within a broader global discourse on mental health in high-risk professions, this study contributes to ongoing efforts to optimize human performance in security operations and safeguard national stability.