

ICMCER 2025

6th International Conference on Multidisciplinary and
Current Educational Research



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Bangkok, Thailand



Transformative Learning for
Sustainable Development: Insights
from Multidisciplinary Research

Organized By



IFERP Academy-Thailand Society

Academic Partner



Shinawatra University, Thailand



6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025),
Bangkok, Thailand

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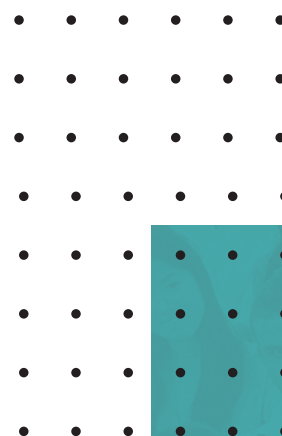


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Conference Theme

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**Transformative
Learning for
Sustainable
Development:
Insights from
Multidisciplinary
Research**

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Preface

We are delighted to extend a warm welcome to all participants attending 6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) organized by Shinawatra University, Thailand & IFERP Academy-Thailand Society taking place in Bangkok, Thailand on March 13th-14th, 2025. This conference provides a vital platform for researchers, students, academicians, and industry professionals from all over the world to share their latest research results and development activities in the field of educational research & various fields. It offers delegates an opportunity to exchange new ideas and experiences, establish business or research relationships, and explore global collaborations.

The proceedings for ICMCER-2025 contain the most up-to-date, comprehensive, and globally relevant knowledge in the field of educational research & various fields. All submitted papers were subject to rigorous peer-reviewing by 2-4 expert referees, and the papers included in these proceedings have been selected for their quality and relevance to the conference. We are confident that these proceedings will not only provide readers with a broad overview of the latest research results in educational research & various fields but also serve as a valuable summary and reference for further research in this field.

We are grateful for the support of many universities and research institutes, whose contributions were vital to the success of this conference. We extend our sincerest gratitude and highest respect to the many professors who played an important role in the review process, providing valuable feedback and suggestions to authors to improve their work. We also extend our appreciation to the external reviewers for providing additional support in the review process and to the authors for contributing

their research results to the ICMCER-2025.

Since November 2024, the Organizing Committees have received more than 200+ manuscript papers, covering all aspects of ICMCER-2025. After review, approximately 90+ papers were selected for inclusion in the proceedings of ICMCER-2025. We would like to thank all participants at the conference for their significant contribution to its success.

We express our gratitude to the keynote and individual speakers and all participating authors for their dedication and hard work. We also sincerely appreciate the efforts of the technical program committee and all reviewers, whose contributions made this conference possible. Finally, we extend our thanks to all the referees for their constructive comments on all papers, and we express our deepest gratitude to the organizing committee for their tireless work in making this conference a reality.



About ICMCER 2025

The 6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) stands as a prominent gathering scheduled for March 13th-14th, 2025, in Bangkok, Thailand. This conference serves as a nexus for academics, researchers, and educators worldwide, fostering the exchange of pioneering research and innovative methodologies across diverse educational spheres. ICMCER-2025 aims to facilitate collaborative discussions, address contemporary educational challenges, and explore emerging trends to drive transformative changes in education. With an emphasis on practical applications and impactful insights, this event endeavors to shape the future of teaching practices and educational policies on a global scale.

Objective of the Conference

The primary objective of the 6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) on March 13th-14th, 2025, in Bangkok, Thailand, is to create a vibrant platform for global scholars, researchers, and educators. The conference aims to facilitate the exchange of cutting-edge research across various educational disciplines. ICMCER-2025 seeks to encourage collaboration, foster interdisciplinary discussions, and showcase innovative methodologies, ultimately aiming to advance educational practices worldwide.

In addition to fostering research exchange and interdisciplinary collaboration, ICMCER-2025 aims to address contemporary challenges in education. The conference endeavors to explore emerging trends and innovative approaches that can effectively tackle these challenges. By providing a space for insightful discussions and presentations, ICMCER-2025 seeks to empower attendees with practical insights and solutions, encouraging the implementation of impactful strategies in educational settings globally. Through this, the conference aspires to contribute to the continuous improvement and evolution of educational research and practices.

Benefits of Conference

Currently, multidisciplinary research has become the most viable and efficient way to solve the problem. In this era of rapidly changing society, many kinds of socio-economic problems, related to other disciplines such as politics, anthropology, psychology, have arisen which require a holistic approach to find their solution.

When we speak of a multidisciplinary, transdisciplinary or interdisciplinary research team, we imply collaboration between people from different disciplines. Thus, the concept of a multidisciplinary research team can be considered as a subset of the concept of collaborative research.



- Access to Expertise
- Stimulates Out-Of-The-Box Thinking
- Formal Division of Labour
- Collaboration Reduces The Isolation Of Researchers
- Transfer of Knowledge & Skills
- Increased Visibility of Work

About IFERP

The Institute for Educational Research and Publication (IFERP) is a professional association devoted to the advancement of the fields of engineering, science, and technology through the funding of research activities, propagation of the latest research insights, furtherance of industry trends, and other related ventures. IFERP aims to digitalize this entire process of innovation, collaboration, and knowledge-sharing through the fostering of a unified virtual scientific community worldwide. Everything from networking and joint ventures to learning, research assistance, publication, and more, will be carried out as part of this objective.

IFERP has established robust scientific, academic, and industry networks throughout Asia, the Middle East, and Europe. Some of the countries that IFERP has its presence in, include Iraq, Maldives, Thailand, Malaysia, Singapore, Philippines, Indonesia, Taiwan, Vietnam, UAE, Australia, Japan, Sri Lanka, Nepal, Ghana, and Africa.

Mission & Vision

Mission: Upskilling the knowledge hub through technological innovation and excellence for the benefit of humanity.

Vision: A Digitally equipped robust, dynamic & swift professional community integrating academics industry for upgraded technical knowledge implementation.

Value & Goal

Value: IFERP values the restoration of high-level technological research, learning, collaboration, resource sharing & community-building traditions.

Goal: To serve as the foundation for all technological progress and advancement activities around the world.

What IFERP Do?

The commitment of IFERP is the dedication to the professional journey by providing access to a high-quality platform. Here's what they focus on

Promoting Innovation: Inspiring creativity and keeping up with the newest developments in engineering, science, and technology.

Collaboration: Actively partnering with institutions, organizations, and associations to build a better future together.

Publication Opportunities: Offering opportunities for research papers to be published in respectable journals, hence enhancing recognition and knowledge dissemination.

Academic Resources: Providing access to educational resources and support for researchers in both rural and urban locations.

Diverse Learning Opportunities: Conferences, webinars, seminars, guest lectures, training courses, and faculty development programs are among the many learning opportunities offered by IFERP.



From Director, IFERP



Mr. A. Siddh Kumar Chhajer

Managing Director & Founder,
IFERP Academy, Technoarete Group.

“

On behalf of Institute For Educational Research and Publications (IFERP) & the organizing Committee, I express my hearty gratitude to the Participants, Keynote Speakers, Delegates, Reviewers and Researchers.

The goal of the 6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) is to provide knowledge enrichment and innovative technical exchange between international researchers or scholars and practitioners from the academia and industries in the field of Educational Research.

This conference creates solutions in different ways and to share innovative ideas in the field of Educational Research. ICMCER-2025 provides a world class stage to the Researchers, Professionals, Scientists, Academicians and Students to engage in very challenging conversations, assess the current body of research and determine knowledge and capability gaps.

6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) will explore the new horizons of innovations from distinguished Researchers, Scientists and Eminent Authors in academia and industry working for the advancements in Science and Engineering from all over the world. ICMCER-2025 hopes to set the perfect platform for participants to establish careers as successful and globally renowned specialists in the field of Educational Research.

From CEO, IFERP



Mr. Rudra Bhanu Satpathy

CEO & Founder,
IFERP Academy, Technoarete Group.

“

IFERP is hosting the 6th International Conference on Multidisciplinary and Current Educational Research (ICMCER-2025) this year in month of March, 2025. The main objective of ICMCER-2025 is to grant the amazing opportunity to learn about groundbreaking developments in modern industry, talk through difficult workplace scenarios with peers who experience the same pain points and experience enormous growth and development as a professional. There will be no shortage of continuous networking opportunities and informational sessions.

The sessions serve as an excellent opportunity to soak up information from widely respected experts. Connecting with fellow professionals and sharing the success stories of your firm is an excellent way to build relations and become known as a thought leader. I express my hearty gratitude to all my Colleagues, Staffs, Professors, Reviewers and Members of Organizing Committee for their hearty and dedicated support to make this conference successful. I am also thankful to all our delegates for their pain staking effort to make this conference successful.

Keynote Speaker



Dr. Abdul Rahim Ridzuan

Department of Economics and Finance,
Universiti Teknologi MARA,
Malaysia.

“

Dr. Abdul Rahim Ridzuan is an Associate Professor and economics lecturer at Universiti Teknologi MARA in Melaka, Malaysia. His academic journey is marked by a strong foundation, holding a Bachelor's degree in International Economics from Universiti Multimedia, a Master's degree in International Economics from Universiti Putra Malaysia, and earning his PhD in International Economics from Universiti Sains Malaysia in 2017. Dr. Abdul Rahim Ridzuan has made significant contributions to academia, having successfully supervised 2 PhD students and 1 master's student, while currently mentoring 6 PhD students. His research expertise extends to key roles at the Big Data Analytics and Artificial Intelligence (IBDAAI) unit at Universiti Teknologi MARA and the Centre for Economic Development and Policy (CEDP) at Universiti Malaysia Sabah. He is also affiliated with the Accounting Research Institute and the Institute for Research on Socio-Economic Policy, both at Universiti Teknologi MARA. Beyond his home country, Dr. Abdul Rahim Ridzuan has been acknowledged as a Visiting Professor at esteemed

foreign universities, including those in Turkey and Indonesia. Presently, he holds the position of Visiting Professor at the University of Cyberjaya in Malaysia. Dr. Abdul Rahim Ridzuan's prolific research record encompasses over 171 publications in various academic outlets. His dedication to advancing knowledge has resulted in securing research grants totaling RM2 million at both national and international levels. His commitment to excellence has earned him more than 60 awards, including recognition as the Most Prolific Author and accolades for his outstanding publications and contributions to consultations.

Keynote Speaker



Dr. Ridwan Sanjaya

Department of Information Systems,
Soegijapranata Catholic University (SCU),
Indonesia.

“

Ridwan Sanjaya is a full Professor in Information Systems of Soegijapranata Catholic University, Semarang, Indonesia. He joined the SCU faculty in 2002, initially serving as a lecturer. He obtained his MSc in Internet and E-Commerce Technology and PhD in Computer Information Systems from the Graduate School of Information Technology, Assumption University, Bangkok, Thailand (in 2006 and 2011, respectively). He has expertise in utilizing technology to transform educational content for students, to align with the business, and to empower people.

Keynote Speaker



Dr. Tarik A. Rashid

Professor in Computer Science/Artificial Intelligence, Director of the Centre for Artificial Intelligence and Innovation, Dean of the School of Science and Engineering, University of Kurdistan Hewler Iraq.

“

Tarik Ahmed Rashid: received his Ph.D. in Computer Science and Informatics degree from College of Engineering, Mathematical and Physical Sciences, University College Dublin (UCD) in 2001–2006. He pursued his Post-Doctoral Fellow at the Computer Science and Informatics School, College of Engineering, Mathematical and Physical Sciences, University College Dublin (UCD) from 2006–2007. He joined the University of Kurdistan Hewlêr (UKH) in 2017. He has also been included in the prestigious Stanford University list with 2.7% of the best world researchers for the year 2020. Tarik is on the list of top 10 researchers in the Al-Ayen Iraqi Researchers Ranking (2022). AIR-Ranking 2022 is a national ranking organized by Al-Ayen University to honour those who have worked inconclusively to promote the Iraqi researcher image in the international domain. A group of highly skilled members has performed the ranking with the condition of the researcher having at least an H-index of 12 with more than 12 research papers in the Scopus database in 2021 and at least an H-index of 6 in WOS. The ranking of the researcher was established by considering several academic network websites that is including Web of Science, Scopus, Sci-Val, ResearchGate, Publons, and Google Scholar.

Keynote Speaker



Dr. Sranya Saengamporn

Chairman of the International Programs for Doctoral and Master's Studies in Educational Administration, Faculty of Education, Shinawatra University, Pathum Thani, Thailand.

“

Asst. Prof. Dr. Sranya Saengamporn is the Chairman of the International Programs for Doctoral and Master's Studies in Educational Administration at the Faculty of Education, Shinawatra International University. She is an Assistant Professor in Educational Administration. Asst. Prof. Dr. Sranya is the Chief Executive Officer (CEO) & Founder of Achievement of Education, an executive exam tutoring course. She has been actively involved at regional, national, and international levels promoting education. She has joined a study tour on educational administration in the U.S.A and Japan.

Keynote Speaker



Dr. Imelda Hermilinda Abas

Lecturer at the Semiotic Department,
School of Liberal Arts,
Shinawatra University, Thailand.

“

Asst. Prof. Dr. Sranya Saengamporn is the Chairman of the International Programs for Doctoral and Master's Studies in Educational Administration at the Faculty of Education, Shinawatra International University. She is an Assistant Professor in Educational Administration. Asst. Prof. Dr. Sranya is the Chief Executive Officer (CEO) & Founder of Achievement of Education, an executive exam tutoring course. She has been actively involved at regional, national, and international levels promoting education. She has joined a study tour on educational administration in the U.S.A and Japan.

Plenary Keynote Speaker



Dr. Saurabh Katiyar

R&D Director, CPG R&D CENTRE &
Head of Technology, Innovations and
Emerging Tech, Charoen Pokphand Group,
Bangkok City, Thailand.

“

Dr. Saurabh Katiyar comes with nearly 29 years of experience and currently serving as R&D Director and Head of Technology [Innovation and Emerging tech] with focus on AI-ML, Digital, Robotics, Communications and Sensing Tech at Chief Technology and R&D Office with Large Global Conglomerate based in Bangkok Thailand with industry focus on Food, Agriculture, Mobility, Digital, Supply chain, Telecom, Financial Services, Sustainability, Retail and Healthcare. Dr. Saurabh's educational background as Dual master's in science and technology, Management Fellow, Medical Bioinformatics expert from NUS National University of Singapore's Yong Loo Lin School of Medicine, and Academic research in many fields – PhD in AI; Biosensing Nanotech-Biotech engineering in Plant Biology; Food Science Applications for Telemedicine in Personalized Food and Nutrition and Quantum Mechanics under Stanford University School of Engineering.

Plenary Keynote Speaker



Dr. Urs Hauenstein

Visiting Professor of Management Education,
Liverpool Hope University,
United Kingdom.

“

Urs Hauenstein, Visiting Professor in Management Education at the Liverpool Hope University, UK. PhD in Education Management; Prof hc for Internationalisation; Volunteer President mult; Visiting, honorary and distinguished Professor mult, Senior and honorary Fellow in different Colleges / Universities in Eastern & Central Europe, United Kingdom and Switzerland. The expertise of Urs Hauenstein is found in the clusters for the future of this world in times of disruption: Lifelong Learning; UpReSkilling, Education and Pedagogy for a Sustainable, Ethical and Resilient Future; T-VET for the Future; Responsive and Responsible Leadership, Governance, Entrepreneurship and Xpreneurship™; Value(s)-oriented Quality Management; Outcomes and Impact oriented Benchmarking; Validation and Valorisation; Accreditation / Recognition of Prior Learning; Assessments and Competences / Competencies and Qualifications; Micro-Credential Evaluation and the different fields of Transformation Education and Management, Holistic Development; SDGs and more.

Plenary Keynote Speaker



Mr. Aakarsh Mavi

IT Systems Engineer II,
Lennox International Inc. Dallas,
Texas, USA.

“

Urs Hauenstein, Visiting Professor in Management Education at the Liverpool Hope University, UK. PhD in Education Management; Prof hc for Internationalisation; Volunteer President mult; Visiting, honorary and distinguished Professor mult, Senior and honorary Fellow in different Colleges / Universities in Eastern & Central Europe, United Kingdom and Switzerland. The expertise of Urs Hauenstein is found in the clusters for the future of this world in times of disruption: Lifelong Learning; UpReSkilling, Education and Pedagogy for a Sustainable, Ethical and Resilient Future; T-VET for the Future; Responsive and Responsible Leadership, Governance, Entrepreneurship and Xpreneurship™; Value(s)-oriented Quality Management; Outcomes and Impact oriented Benchmarking; Validation and Valorisation; Accreditation / Recognition of Prior Learning; Assessments and Competences / Competencies and Qualifications; Micro-Credential Evaluation and the different fields of Transformation Education and Management, Holistic Development; SDGs and more.

Plenary Keynote Speaker



Mr. Sanat Talwar

Security Software Engineer,
Electronic Arts,
USA.

“

Sanat Talwar is an independent researcher specializing in cybersecurity, cloud infrastructure security, and threat intelligence. His research focuses on identifying vulnerabilities in cloud-native environments, with a particular emphasis on DNS security, automated threat detection, and network reconnaissance. With extensive experience in penetration testing, security automation, and incident response, he has contributed to various security research initiatives aimed at improving cloud-based security frameworks. His work includes developing real-time security monitoring systems, AI-driven risk detection models, and automated reconnaissance tools to mitigate threats in cloud environments, gaming security, and enterprise network infrastructures. His research seeks to bridge the gap between academic cybersecurity advancements and real-world application, ensuring practical, scalable, and effective security measures for emerging technologies

Session Speaker

“



Dr. Raj Kumar Singh

HOD (Deptt. of Commerce) & Head (R&D),
School of Management Sciences,
India.

An Entrepreneurship & Startups Incubation Expert, MSME Expert, Researcher, Academician, Trainer, Consultant. Done B.Sc.(Hons) from Institute of Science, BHU, MBA (FMS-BHU), Ph.D., UGC-NET, PG Diploma in Export Management, PG Diploma in Journalism and Mass Communication and Certificate in Yoga (BHU). Presently Serving As Professor, HOD (Deptt. of Commerce), Head-Research & Development, Member-Academic Council, Chairman-Board of Studies, Chairperson-Centre For Entrepreneurship, Innovation & Skill Development, President-Institution Innovation Council, Chairperson-Centre For Advanced Research & Development, Chairperson-Centre For Public Policy Development in the School of Management Sciences, Varanasi An Autonomous UGC NAAC “A” Grade Accredited India’s Amongst Top 50 B-Schools. Also Chairperson-Centre For International Relations & Accreditation, Senior Member-IQAC, Senior Member-NAAC Accreditation, Coordinator of Consultancy Cell and Coordinator of MDP. Published Research Papers in various National and International Journals and presented papers in National and International Conferences, Summits and Workshops. Written Books, Edited Books, Book Chapters. Invited in over 200 various Foreign, Central, State and Private Universities, IIMs, IIT, IIIT, Ministry of MSME, Ministry of Agriculture & Farmers Welfare, Management Institutes,

Government Institutions etc. in Conferences, Seminars, Webinars, Workshops, FDP, QIP, MDPs and EDPs as a Key Note Speaker, Visiting Faculty, Consultant and Trainer in the area of Startups & Entrepreneurship Development, Design Thinking, Innovation Management, Incubation Management, Case Writing and Qualitative Research etc. Organised Several National and International Conference and Workshops. Having over 30 Years of Academic, Research and Corporate Experience in the field of Consumer Durables, FMCG & Pharmaceuticals Sector on leadership role as CEO and GM. Done Turnaround of various MSME units. Founder Managing Editor of Refereed Peer Review Journal named ‘SMS Journal of Entrepreneurship & Innovation’ of SMS Varanasi. Technical Advisory Board Member of Ministry of MSME, Startup Mentor-IIM Kashipur, KIIT University, Startups India, Executive Body Member of Quality Circle Forum of India, Chapter Chairman of Public Relations Society of India, associated with several Professional and Social Organisations. Incubated over 100 Startups and Honoured with National & International Awards & Accolades

Session Speaker



Dr. Trilochan Tripathy

XLRI Xavier School of Management,
Jamshedpur,
India.

“

Dr. Trilochan Tripathy joined XLRI as a faculty of Finance in February 2016. Dr. Tripathy has over 18 years of strong research consultation and management training experience under grants, contracts and fee for service basis with industry, independent agencies and organizations. His current research interests are in the broad areas of market integration, cross listing, currency risk modeling, banking liquidity crisis and regulations and asset pricing and valuations. He has published over 50 articles and some of them are in the Journal of Applied Economics, Journal of Quantitative Economics, Resources Policy, Int. Journal of Applied Economics and Finance, Int. Journal of Behavioral Accounting and Finance, Review of Developmental Finance, Int. Journal of intellectual capital and learning etc.. His current teaching interests are in the areas of Corporate Finance, International Financial Management, Futures and Options, Financial Markets and Institutions, Financial Analytics and Computational Finance. Dr. Tripathy has also guided 10 Ph.D Scholars across different areas of finance such as asset pricing, portfolio Management, commodity derivatives, Strategic Asset Management and Competition and Ecosystem.

Session Speaker



Dr. Paul John P. Infante

College of Engineering Education,
University of Mindanao,
Davao City, Philippines.

“

I am an Associate Professor at the College of Engineering Education of the University of Mindanao under the Electrical Engineering Program, teaching professional and physical science course subjects. I am studying for my Doctor of Engineering, specializing in Energy Engineering, at the University of San Carlos, Cebu City, with a research interest in Power Quality. I finished my Master of Engineering Program majoring in Electrical Engineering at the University of Southeastern Philippines, which deals with the research topic of electrical power distribution and management systems in buildings, and also finished my Bachelor's Degree in Electrical Engineering and I worked in the research of energy reduction through electromagnetic shielding in appliance electrical cords. I am affiliated with the Institute of Integrated Electrical Engineers of the Philippines, Inc., and a Scholar grant from the Department of Science and Technology during my undergraduate and postgraduate. I have patents for utility models and have published research papers in quality international journals such as the Journal of Electrical Systems and the International Journal of Research and Scientific Innovation. I have paper presentations at world conferences. I am currently working in power harmonics, which is one of the power quality issues that are generated in the power system. I focus on the demand Side's lighting technologies and lighting systems that align with the sustainable development goals of affordable and clean energy, industry, innovation, infrastructure, and sustainable cities and communities.

Session Speaker



Dr. Morakinyo Dada

Senior Lecturer,
Asia Pacific University of Technology and
Innovation (APU / APIIT), Malaysia.

“

Dr. Morakinyo Dada is a Senior Lecturer and Programme Leader for Marketing Management and Digital Marketing at Asia Pacific University of Technology and Innovation (APU). His research explores the intersection of emerging technologies—particularly Artificial Intelligence, blockchain, and the metaverse—and their influence on digital marketing, consumer behavior, and FinTech innovations such as cryptocurrency and crowdfunding. A prolific scholar, Dr. Dada has published multiple Scopus-indexed papers and has served as a reviewer and session chair for various academic conferences. He also leads the Electronic Journal of Business and Management (EJBM) as Chief Editor, overseeing six papers across four issues annually to advance discourse in business and management studies. Dr. Dada holds a Certified Digital Marketing Professional (CDMP) credential from the Digital Marketing Institute (DMI) and serves as a liaison officer between DMI and APU, bridging academia and industry. Through his work, he remains committed to fostering innovation, shaping marketing best practices, and guiding the next generation of industry leaders.

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Committee Members

Meet the ICMCER Organizing Committee, the dedicated team working tirelessly to make your conference experience exceptional! Comprised of passionate volunteers, they're the masterminds behind the scenes, ensuring every detail is perfect. From meticulous planning to flawless execution, they invest countless hours to deliver a top-notch event. So, as you enjoy engaging sessions and networking, remember to thank these incredible individuals for their hard work and dedication. They're the reason ICMCER is a success!

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Strategic Enhancement of Comprehensive Japanese Internship Programs at Job Training Institutions in Indonesia: A Strategic Development Approach Using The CIPPO Model and SWOT Analysis

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Indonesia continues in improving the quality of human resources (HR) and reduces the unemployment rate by creating competent labors which are ready to compete in the global market through the Japanese apprenticeship program which is a collaboration between the Indonesian and Japanese governments. It aims to provide opportunities for Indonesian youth to learn technology, discipline, work ethic, and high work culture from Japan. As the provider, the job training institution (LPK) has a role important to train and debrief for prospective Japanese apprentices, thus it needs an evaluation program and optimization strategies. This article focuses on the Japanese language training and apprenticeship program that are organized by LPK using CIPPO model (Context, Input, Process, Product and Outcome). Furthermore, descriptive analysis is used by analyze data interview, observation, and SWOT analysis (strength, weakness, opportunity, threats). The results of CIPPO analysis and SWOT analysis found an institutional policy development strategy by establishing cooperation with labor offices (Disperinaker), Vocational High School, Government Banks and other Accepting Organizations (AO). In addition, influencers are involved to get better marketing by creating interesting contents. The quality and quantity of the output in that institute would be increased if the strategies are implemented to achieve long-term goals.

Social Attitude in Implementing the Strategy of Islamic-Based Character Education on Children with Special Needs

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Character education is very hard to implement in an inclusive school, especially for children with special needs. An Inclusive school needs some treatment or strategy for children with special needs to achieve their objective goal study. This phenomenological study explored the implementation strategy of Islamic-based character education on children with special needs in Harsya Inclusive School Banda Aceh, Indonesia. This research approach is qualitative research. Data collection was carried out through interviews with 7 teachers from Harsya Inclusive School. Data analysis was performed using ATLAS. ti 22 software. The results showed that the implementation strategy of Islamic-based character education in Children with Special Needs in Harsya Inclusive School Banda Aceh Indonesia includes friendly and communicative, observation, social care, Image media, evaluation, independence, Therapy, religious value, discipline, communication, patience, reward, understanding of children, training, Sentra, regulation, cooperation with parents, mentoring, habituation, moral value, punishment, repetition, storytelling. From this implementation, it turns out that there are social attitudes obtained in the implementation of Islamic-based character education, including friendly and communicative, socially caring, independent, disciplined, communication skills, patient, and morally valuable. We think they will benefit from a complete understanding of strategies for implementing Islamic-based character education, especially for children with special needs.

Index Terms

Strategy; Character Education; Children with Special Needs; Social Attitude

Analysis of Chemistry Learning Based on Ethnoscience of Papuan Indigenous People For High Schools in South Papua Province

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The Merdeka curriculum in Indonesia aims to build the foundation and character of education through local wisdom to develop student competencies in accordance with characteristic and cultural environment of students. Chemistry learning is closely related to daily life of Papuan indigenous people in Merauke district, South Papua province because their local wisdom contains indigenous sciences related to chemistry which is called ethnoscience as a learning model. Ethnoscience-based chemistry learning can be a solution that makes students easier to understand chemistry material. The aim of this research is to determine the extent to which Papuan ethnoscience-based chemistry learning is implemented in high schools. Method used in this research is descriptive qualitative starting from planning, implementation and evaluation. The results of the research show that ethnoscience-based chemistry learning planning has not been applied to all chemistry topics. The implementation stage, several chemical materials have integrated ethnoscience with local culture, including medicinal plants, local food and ornamental ceremonies, in indigenous people in Merauke district, South Papua Province. At the evaluation stage, it is carried out through student learning outcomes which consist of cognitive assessment, affective and psychomotor skills which overall show good results for sustainable learning in chemistry.

Enhancing Vocabulary Retention Through Cognitive Strategies: The Impact of Wordwall in Virtual Learning Environments

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The increasing need to maintain student engagement in digital learning has encouraged researcher into cognitive strategies for effective vocabulary acquisition among young learners. This qualitative study examined the use of Wordwall, an interactive web-based tool, and its influence on vocabulary learning in elementary school students. Through a case study approach, the research explored the cognitive strategies employed by 15 students as they interacted with Wordwall in a non-formal education context. The Findings showed notable improvements in students' vocabulary acquisition, highlighting role of Wordwall in enhancing both vocabulary mastery and intrinsic motivation. Individual student interviews further revealed how Wordwall's interactive design and visual aids facilitated deeper cognitive processing, making learning more engaging and enjoyable. Despite some challenges with complex vocabulary and lengthy questions, the study highlighted the role of Wordwall in fostering deeper cognitive engagement and enhancing vocabulary acquisition through targeted learning strategies. These insights offer valuable implications for integrating digital tools that support cognitive processes in language learning, particularly in improving vocabulary retention and learning outcomes.

Javanese Marriage: Respecting Kejawen Traditions Based on Islamic Teachings

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Javanese weddings are rituals rich in meaning and cultural values. This article discusses the combination of Islamic teachings and Javanese traditions in Javanese wedding ceremonies that reflect the harmony between spiritual beliefs and local wisdom. Islam, as the majority religion in Java, significantly influences wedding ceremonies, and Javanese traditions are maintained as the cultural identity of the Javanese people. This study aims to analyze how Islamic values become the main foundation in Javanese wedding ceremonies but still maintain and respect the Javanese traditions that are thick in Javanese culture. This research method uses a qualitative approach with participatory observation techniques, in-depth interviews, and documentation. The study results show that Islamic law is the main foundation of marriage, and it uses prayers, ijab kabul, dowry, and the Prophet's Sunnah. The Javanese tradition is still preserved, through siraman, midodareni, and panggih. This finding emphasizes the importance of a harmonious balance between faith in the religious values of religious teachings and the preservation of ancestral cultural heritage so that it can create a sacred and meaningful marriage for the Javanese people. This study is expected to provide deeper insight into the interaction between religion and culture in Indonesia's marriage context.

Index Terms

Culture; Islamic Teachings; Javanese Wedding; Kejawen Tradition; Ritual

Mapping the Themes and Identifying Gaps in DLSZ Research Towards a Comprehensive Research Agenda

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The establishment of the De La Salle Santiago Zobel School (DLSZ) Research Office has identified the pillars of the institution's research culture through its initiatives, underscoring the institutional research goals and anchors of the research priorities based on the DLSZ Strategic Plan Framework. As the research culture gradually develops, the growth of research engagement of personnel becomes evident leading to an increase in research outputs. The present study synthesizes 18 research outputs of administrators and faculty members from AY 2021–2022 until AY 2023–2024, at the height of research development required for a capacity-building workshop. Analysis of the studies were conducted in terms of key characteristics and research goals. The findings reveal alignment of the research goals with the DLSZ strategic goals of Academic Excellence, Operational Excellence, and Impact to Society, with a few studies addressing multiple goals. Several common themes associated with the strategic goals emerged, including enhancement of academic outcomes, technology integration in teaching and learning, leadership and professional development for students and educators, and post-pandemic educational adaptations. However, the present study identified the need to explore longitudinal studies, holistic factors integration, and ethical implications in the use of technology, which through prioritization can strengthen the research agenda.

Index Terms

DLSZ Research Outputs, Descriptive Review, Research Anchors and Pillars, Thematic Research Mapping, Technology Integration in Education, Identifying Research Gaps, and Research Agenda

Lasallian Leader in Me: Reinforcing Lasallian Values, School Engagement, and Student Leadership

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The Lasallian Leader in Me (LLiM) is a strategic program that is based on the Lasallian Core Values (LCVs) of Spirit of Faith, Zeal for Service and Communion in Mission and 7 Habits of Highly Effective People. De La Salle Santiago Zobel School (DLSZ) embarked on a whole-school transformational process that teaches 21st-century leadership and life skills using the Leader In Me™ framework. DLSZ's Brother Rafael Donato Night High School (BRafeNHS) ran the pilot implementation in AY 2020–2021. This study examined the LLiM program in BRafeNHS and its impact on reinforcing the Lasallian Core Values and enhancing school engagement, specifically on participation in student leadership-related activities from AY 2022–2023. A mixed-method approach was utilized with quantitative data by students' pre-assessment (n1=538) and post assessment (n2=468); faculty (n3=24); and parents (n4=311) derived from the survey results. Qualitative data derived from document analysis and interviews conducted with stakeholders, comprising students (n5=5), faculty members (n6=9), and parents (n7=5) gained a deeper understanding of their experiences with the LLiM implementation. Results provide evidence that the LLiM program has enhanced the Lasallian Core Values, increased school engagement through student leadership activities among the BRafeNHS students.

Index Terms

School Values, Student Leadership, School Engagement, Behavioral Indicators, Lasallian Values

Teaching English Vocabulary to Young Learners Through the Tune of Song: Rural Areas Context

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Students must possess a wide range of vocabulary to excel in the four language skills of English: listening, speaking, reading, and writing. Students should expand their vocabulary by learning new words and understanding their meanings to utilize them correctly. Mastering vocabulary aids pupils in improving comprehension and facilitates more effective knowledge transfer. Teaching language poses a problem for teachers, particularly when instructing young learners. Young learners who like studying in a fun manner want teachers to use unique strategies while teaching vocabulary. This study aims to investigate the teacher's strategy in teaching young learners vocabulary. This study was descriptive qualitative research conducted in one of the courses in NTB which was located rural areas. In collecting the data observation and interview were conducted. The results showed that teaching vocabulary through the Tune of Song can be an effective alternative for teachers instructing young learners. This technique will facilitate collaborative learning of vocabulary among pupils.

Trust in Higher Education

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Referring to a system theoretical framework and utilizing a mixed-methods approach, combining quantitative data from surveys (N=193) and qualitative insights from interviews (N=4), this study investigates the concept of trust in higher education among Danish humanities and social sciences students. The study identifies three distinct dimensions of educational trust. Trust in institutional performance encompasses students' confidence in the knowledge and teaching they receive and its applicability beyond university, while trust in institutional values/symbols pertains to the alignment of university values with student expectations. Trust in fellow students reflects the perceived support and engagement from peers. The study uses cluster analysis to investigate if students within the same university seem to agree on trust or if there are different student groups with varied trust profiles across the three trust dimensions. This analysis reveals four student groups with varying trust levels. One of the groups (28.5% of the students) is characterized by having very high trust across all dimensions, while another (25.4%) is characterized by having high trust. A third group (16.6%) has very high trust in institutional performance and values/symbols, yet only medium trust in fellow students. The last group of students (29.5%) has medium educational trust across all dimensions. We nuance our quantitative findings based on interviews with students that have varied trust profiles in the quantitative study. The interviews illustrate the diverse experiences and perceptions of trust and its antecedents among students, thus highlighting the complexity of trust dynamics in educational settings.

Index Terms

Higher Education; Educational Trust; Systems Theory; Humanities, Social Sciences; Students Perspective; Denmark

Talented Students' Transformative Learning and Trajectories

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This presentation investigates the trajectories of selected talented STEM students, focusing on transformative learning. Through a longitudinal quantitative study of 240 participants and qualitative study of 15 students, it examines their diverse paths and engagement profiles over 10 years. The research reveals that talent development is non-linear and influenced by personal values and motivation, social context, and educational practices.

Key findings show that only a small percentage of participants maintain a consistent interest in STEM, with many shifting to other fields. The study underscores the importance of recognizing and nurturing different types of engagement—behavioral, affective, cognitive, and social—to support the transformation of potential into talent. It highlights the role of pedagogical practices as catalysts for engagement and talent development, advocating for a flexible, supportive, and context-sensitive approach to foster transformative learning experiences.

By integrating theoretical frameworks and empirical data, the presentation proposes a comprehensive model for understanding and enhancing talent development through transformative learning. This model emphasizes the dynamic and complex nature of talent actualization. Referring to the model, we in the presentation suggest educational strategies that adapt to the evolving needs and preferences of talented students.

A Theoretical Development of Robotics Technology Pedagogical Approach (RTPA) in Mathematics Education

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Robotics and mathematics are deeply intertwined fields, with mathematics serving as the backbone for many aspects of robotics. This Explanatory Sequential Design (ESD) research aims to establish a Robotics Technology Pedagogical Approach (RTPA) as a theory in Mathematics Education. The RTPA Training Manual was designed and developed to provide a diverse pedagogy in teaching Mathematics using ADDIE Model. Thirty (30) Mathematics Teachers were purposively selected through inclusion criteria. The RTPA training-workshop integrated Arduino IDE for programming microcontrollers, Tinkercad, and Creaality for 3D printing technology on mathematics topics such as algebraic expression, arithmetic and geometric sequences, simulator scientific calculator, protractor, measurement, and 3D polygons. The participants answered the proficiency test and in-depth interview after the training. Based on the formulated Mathematical Learning Model, the researcher established an RTPA Theory. Based on the formulated Mathematical Learning Model, the Robotics Technology Pedagogical Approach Theory is an interdisciplinary approach that aims to stimulate curiosity and computational thinking of learners to enhance 21st-century skills, promote higher-order thinking skills, improve problem-solving and mathematical skills, and increase numeracy skills and critical thinking skills in mathematics. Since RTPA activities are interesting, engaging and useful in class, Mathematics teachers can use this approach for hands-on learning, interactive drills and boost mastery, interdisciplinary connections, real-world applications in mathematics and provide authentic assessment. Integrating robotics technology into mathematics education in a theoretically grounded manner can enhance learning outcomes and foster students' mathematical understanding and problem-solving skills. With this, educators can design robotics-based math activities grounded in pedagogical principles and promote meaningful learning experiences.

Index Terms

Robotics Technology, RTPA, Mathematics, Grounded Theory

ET-based Irrigation System with Automated Bird Deterrent System and Water Quality Monitoring

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This project design integrates advanced environmental monitoring and machine literacy ways to address challenges in husbandry, fastening on effective water operation and securing crops from hardware- related damage. The system employs detectors to measure essential environmental parameters similar as evapotranspiration (ET), soil humidity, temperature, and pH situations. Grounded on the data, it stoutly calculates water conditions for crops, icing optimal irrigation while conserving water coffers. An automated irrigation medium activates when humidity situations drop below the threshold, enhancing water- use efficiency. Cover crops, the system incorporates a hardware interference medium. Using stir discovery powered by a trained deep literacy model, the system identifies raspberry exertion in the field. If the detected raspberry count exceeds a predefined limit, an alert is transferred to the planter via SMS using Twilio, and truculent conduct are actuated automatically to alleviate implicit damage. This design combines IoT bias, real-time data processing, and robotization to enhance agrarian productivity and resource conservation, furnishing a cost-effective and scalable result for ultramodern husbandry challenges.

Index Terms

Automated Irrigation, Evapotranspiration, Bird Deterrent, Penman-Monteith Equation, Precision Agriculture, Water Conservation

A Proposal for a System that Provides Book Encounters for a Better Reading Experience

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This study seeks to design innovative methods for encountering books and redefining the value of reading in a modern society where reading habits are declining. In an era dominated by digitalization and efficiency-driven consumption, the serendipity, physical engagement, and joy of discovery that reading once offered have become increasingly scarce. To address this issue, the study proposes a system that merges the advantages of physical books and e-books, introducing the concept of a “Reading Map” where readers can discover books by physically visiting specific locations. This mechanism leverages behaviors and emotions such as pilgrimage and collection-oriented interests, creating a unique reading experience that combines exploration and personal interaction with literature. When visiting designated spots, users gain access to related book information, fostering moments of surprise and inspiration driven by chance. Furthermore, collectable elements are incorporated to maintain long-term reading motivation, while features like visualized maps and collection histories stimulate the user’s intellectual curiosity. Drawing from prior examples such as library systems supporting serendipitous encounters, pilgrimage culture, and the psychology of collecting, this approach diversifies how reading is experienced in contemporary contexts, providing a richer, more immersive and meaningful interaction with books.

Integrating VARK Learning Styles and Eye-Tracking Technology in Dance Education: Insights into Visual Attention and Instructional Strategies

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The synergy between VARK learning styles and instructional strategies offers a novel perspective for addressing individualized learning needs. This study investigates the application of eye-tracking technology and VARK learning styles in dance education, focusing on visual attention distribution during movement learning. The students who were pre-service teachers' learning styles were classified using the official VARK questionnaire, and conducted movement instruction based on VARK strategies. Eye-tracking data were collected as participants viewed videos before and after instructional, and follow-up interviews explored their learning experiences. Results showed that among the 11 students, most were multimodal learners (MM), with others classified as strong kinesthetic (SK) and mild kinesthetic (MK); all preferred kinesthetic instructional strategies. Before instruction, MM and SK students primarily relied on textual information processing, while post-instruction, they demonstrated increased attention to images. The MK students maintained a stable preference for both text and images throughout. Sequential analysis further revealed that, before instruction, students' visual attention was initially focused on textual elements, then shifted toward hand and foot movements. After instruction, they displayed improved coordination in visual attention patterns, with more frequent shifts between hand and foot actions. Interview data indicated that students perceived multimodal learning strategies, shifts in focus, repetitive practice, and role-playing as significantly enhancing their dance learning outcomes. The integration of eye-tracking with VARK learning styles not only suggests the need for diverse instructional strategies to accommodate individual learning needs but also provides innovative insights and approaches for future educational practice, with substantial theoretical and practical implications.

Index Terms

Dance Education; Movements; Eye-Tracking; Learning Styles

Micro Finance Institutions and Socio-Economic Upliftment of Fisher Folk Community: Evidence from Thiruvananthapuram District

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In India, the fisheries sector in Kerala is considered as one of the important sectors and the coast of Kerala is the most fertile location of Arabian Sea. In recent years, Fisher communities are facing a various type of financial crises, due to ineffective government policies and natural calamities and pandemic of covid 19. People in Poovar, Poonthura, and areas of Thiruvananthapuram district are well attracted to Micro Finance institutions for their immediate financial needs. It needs to be examined whether microfinance institutions are more important in the social and economic livelihoods of fisher workers in this area. Most of the traditional fisher folk people are not economically well off. Fisher folk communities are important and notable communities in India. They are producing more fisher products. The social and economic conditions of this area are not very well. The fisher folk communities are marginalized communities and they are needing money for their livelihood. At the time of emergency funds, they are goes to the micro finance institutions to take loans. The MFI are helps this communities. Microfinance, is which means Microcredit. It is a small-scale banking service provided to unemployed or low-income individuals or certain groups who otherwise would have no other access to financial services.

Index Terms

Micro-Credit, Financial Inclusion, Fisherfolks, Marginalization

Enhancing Graduates' Employability (GE) through a Sustainable Business Incubator Model: A Case Study at Jiangxi Institute of Fashion Technology in China

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Graduates' employability (GE) is a critical concern for higher education providers (HEPs) worldwide, reflecting the quality of academic programs and their alignment with industry demands. In today's competitive job market, traditional metrics like employment rates are no longer sufficient. Modern approaches emphasize entrepreneurial initiatives, equipping graduates to create their own ventures. This shift is especially significant in creative industries like fashion, where innovation and adaptability are crucial. At Jiangxi Institute of Fashion Technology (JIFT) in China, a sustainable business incubator model addresses these challenges. By engaging alumni entrepreneurs as mentors, the model provides final-year students with hands-on industry experience. Students gain practical skills, industry insights, and valuable connections, while alumni benefit from access to a pool of motivated talent. This dual advantage enhances student readiness for the workforce and supports alumni businesses. The incubator's structure includes resource-sharing, mentorship programs, and collaborative projects that bridge academic and professional environments. Outcomes include increased employment rates, new entrepreneurial ventures, and strengthened alumni networks. The model's scalability and adaptability suggest its potential for broader application in other institutions and industries. This paper underscores the value of integrating academic programs with industry practices through innovative models like business incubators. By fostering collaboration and entrepreneurship, HEPs can better prepare graduates for today's complex job market and contribute to sustainable economic growth.

Index Terms

Alumni Entrepreneurship, Business Incubator, Fashion Program, Internship, Sustainable Business Models

Analysis on Activity-Based Costing Approach for JD Logistics Warehousing Operation (Nanning Area)

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This study aims to apply the Activity-Based Costing (ABC) method to analyze and optimize the warehousing operations of JD Logistics, focusing on its Nanning Intelligent Logistics Park.

As China's e-commerce sector grows, logistics costs remain a significant challenge, with warehousing identified as a key cost driver. By implementing the ABC approach, this research seeks to accurately allocate costs, identify inefficiencies, and propose targeted improvements in operational processes. Using data from 2022 to 2023, the study examines the park's cost structure and operational practices, offering insights into cost reduction and efficiency enhancement. The application of ABC will not only provide a detailed understanding of logistics costs but also support evidence-based recommendations for optimizing resource utilization.

This research contributes to advancing cost management practices in self-built logistics enterprises and offers valuable implications for the broader e-commerce logistics industry.

Correlation Analysis of Physical Conditioning Components and Performance Outcomes in Middle-Distance Runners: A Study on Student-Athletes

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This study examines the complex relationship between biomechanical factors, energy expenditure, and mechanical power, focusing on their collective impact on middle-distance running performance. It emphasizes the critical role of mechanical power in shorter events like the 800 meters, where explosive strength, acceleration, and speed are key for competitive success. In contrast, longer events, such as the 3000 meters, rely more on energy utilization and aerobic endurance, highlighting the importance of efficient energy management over time. The research advocates for concurrent training, which combines strength and aerobic conditioning. This approach is essential for optimizing both physiological and mechanical performance, enabling athletes to sustain high-intensity efforts while reducing fatigue. By incorporating these training methods, athletes can enhance power output and aerobic capacity, both crucial for success in middle-distance events. The findings reveal strong correlations between physical assessments, including strength, speed, and endurance, and actual race performance. This suggests that a balanced combination of these attributes is necessary for optimal performance. While mechanical power is vital in shorter races, endurance and energy management become more important in longer distances. Additionally, the study highlights the value of personalized training programs that cater to an athlete's individual strengths and weaknesses, fostering long-term development and maximizing performance in competitive middle-distance running.

Index Terms

Endurance, Running, Strength, Physical Conditioning

Dynamic Monte Carlo Simulation of Fire Occurrence in Tropical Peatland Using Logistic Regression Approach

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Peatland fires significantly impact the ecosystems, climate, and livelihoods of human, necessitating effective predictive models and mitigation strategies. This study develops a dynamic logistic regression model to estimate the probability of fire occurrence based on spatial, temporal, and environmental factors, specifically focusing on key peatland hydrological areas in Indonesia. Static variables in this study are distances to roads, river, coastline, and combine with dynamic variables such as distance to settlement, distance to nearest forest, weather conditions during dry season, landcover, and landuse. The iterative simulation framework integrates annual updates by recalculating distance between mid-point of polygons and critical features, reflecting the impact of landuse change caused by fires. Using this approach, fire probabilities for subsequent years are predicted, enabling the model to adapt dynamically to evolving environmental conditions.

Model performance is evaluated using Dice-Sorensen index, demonstrated high accuracy in replicating historical fire patterns. This iterative methodology highlights the significant influence of proximity to settlements and landuse changes on fire risks. Furthermore, it offers a robust foundation for long term fire prediction and mitigation planning. The finding provides critical insights for sustainable peatland. Future research can enhance this framework by incorporating machine learning technique and high-resolution geospatial data.

Exploring the Role of Artificial Intelligence in Shaping Creativity and Employee Personal Development

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This study examines the impact of artificial intelligence capabilities (AIC) on creativity and employee personal development within the higher education sector. Data were collected through 20 semi-structured interviews from both public and private colleges and analyzed using a three-phase coding process: open, axial, and selective coding. The survey aimed to assess employees' prior experiences with AI-based technologies, their understanding of AI, and their expectations regarding its potential benefits and drawbacks. The findings identified four key themes: (1) Artificial Intelligence Capabilities (AIC), (2) Employee Personal Development, (3) Creativity, and (4) Techno-Stress. The study highlights both the positive and negative aspects of AIC in the workplace. While AI has the potential to enhance creativity and foster individual and collective development, it also introduces new sources of stress. These findings underscore the need for effective training, clear communication, and realistic expectation management. The study concludes that optimizing AI integration in professional environments requires a thorough understanding of its capabilities and limitations to maximize its benefits and address its challenges.

Index Terms

Artificial Intelligence Capabilities (Aic), Employee Personal Development, Creativity, Techno-Stress And Qualitative Analysis

The Road Safety Advocates of The Philippines (RSAP): A 10 Years Assessment and Strategic Roadmap for The Next Decade

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This study explores the effectiveness of the Road Safety Advocates of the Philippines (RSAP), a non-governmental organization (NGO) championing road safety in the Philippines. Employing a mixed-method approach, the research combines a survey targeting RSAP's followers and an internal analysis of the organization itself.

The study investigates the demographics of RSAP's base, their assessment of the organization's performance, and desired future directions. Survey findings reveal a male-dominated (78%) membership base concentrated in the 35–44 age group. Nearly half (46%) of respondents held college degrees. Majority (69%) are employed, which primarily (36%) comes from the food businesses and private institutions. Social media is the primary engagement platform, with high satisfaction expressed towards RSAP's services. RSAP is viewed to have strong leadership, social media presence, and a robust supporter database. Opportunities include services tailored for women riders, harnessing political power, and establishing a Road Safety Academy. Potential threats encompass limited staff and volunteer training, and competition from other motorist-oriented parties.

The study concludes that RSAP plays a significant role in motorcycle riders' and motorists' safety. By addressing its weaknesses and capitalizing on its strengths and opportunities, particularly through formalization, informative publications, and engaging women, RSAP can solidify its leadership position. Fostering collaboration with law enforcement and effectively responding to competition are crucial for long-term success.

This research contributes academically to the understanding of advocacy group effectiveness in the Philippines and offers practical insights for RSAP to enhance its performance and impact.

Index Terms

Road Safety, Law Enforcement, Advocacy, Collaboration, Social Media

Experiences of Bullying Among Special needs Students in Inclusion Classrooms: A Literature Review

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Bullying is a negative experience that poses a risk to students at all educational levels. To combat bullying, the Ministry of National Education and various civil society and educational institutions working on social-emotional development are conducting research and intervention studies. While existing efforts include training programs aimed at fostering appropriate peer behaviors, broader policies are also needed to raise societal awareness. Furthermore, special needs students are at a double disadvantage in the context of bullying due to various factors. This study examines the statistical risk ratios of bullying experienced by special needs students in inclusion classrooms, analyzes related research conducted in Turkey and globally, and highlights the academic, psychological, and social impacts of bullying using up-to-date resources. Prevention and intervention strategies against bullying are also summarized, followed by general inferences and recommendations.

Bitterness in Sweetness: A Sustainable Model for The Sugarcane Industry

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Sugarcane is one of the important cash crops grown in the Philippines and its products serves as an important raw material and ingredients to various sectors of the economy, especially food processing, fast-moving consumer goods (FMCG) and ethanol companies. This crop is planted throughout the country but is most abundant in the Visayas and particularly on Negros and Panay Islands. The study explored the current state of the sugarcane industry in the fourth (4th) district of Iloilo, Philippines, C.Y. 2023. The findings were used as basis in developing a proposed sustainability model for the sugarcane industry.

This study applied the case study research design in determining the current state of the sugarcane industry in the fourth (4th) district of Iloilo, Philippines, C.Y. 2023, with both primary and secondary data. This focused locale is Passi City, San Enrique, Dingle and Barotac Nuevo. The data about the profile of the sugarcane industry in terms of annual production of sugarcane, land use for cultivation, value of sugarcane industry, number of planters, and number of sugar mills was obtained at the City Agriculture Office (CAO) of Passi City and the Provincial Agriculture Office of the Province of Iloilo, Philippines. The participants of this study were the 12 owners, administrators, and trusted personnel of the sugarcane farms and milling entities. A researcher-made interview guide consisting of three (3) parts, was used to gather primary data. Descriptive statistics was used to analyze the profile of the sugarcane industry, while thematic analysis was used to analyze the data gathered through interviews.

In terms of the profile of the sugarcane industry in the fourth (4th) district of Iloilo, Philippines, the biggest land area that was planted with sugarcane was 12,680 hectares in 2021–2022, the highest quantity of cane that was produced was 797,713 tons in 2018–2019, the raw sugar production in 2021–2022 was 62,227 tons, there were 5,530 hectares of land used for cultivating sugarcane, the highest production of raw sugarcane was 62,227 tons and 56,451,401 kilograms of raw sugar with the value of Php2,709,667,248.00 in 2021–2022 at Php 48.00 per kilo. While for farm size of below five (5) hectares, there were 3,848 farms, comprising of 43.53% of all the farmers, only two (2) sugar mills in the Province of Iloilo, Region 6 in the Philippines. The themes created for the information on the crucial strategies applied by the management of sugarcane farms or haciendas and milling companies in the fourth (4th) district of Iloilo, Philippines are Plowing and Harrowing as Field Preparation, Crop Residue Mulching, Model Farm as Benchmark for Variety Selection, Cuttings as Alternative Planting Material, Weed Control and Fertilizer Application, Bagasse as Feedstock for Biofuel Production, Solid Crop Residue as Organic Fertilizer, and Using Molasses as Source of Vitamins for Farm Animals. The themes created for the information on the external factors that affect the sustainability of the sugarcane industry in the fourth (4th) district of Iloilo, Philippines are: Philippine Policy on Sugar Importation Policies Influenced Market Dynamics, Peso-Dollar Exchange Rate Instability Leading to Higher Input Prices, Skyrocketing Costs of Production, Economic Crisis, and Strong Typhoons and Extreme Heat and Drought. The themes created for the information on how the management of the sugarcane farms and milling companies address issues when arise are Chemical Pesticide for Pest and Disease Control Towards Maintaining Quality Harvest, Proper Pesticide and Herbicide Usage, Neutralizing Soil Acidity with Right Fertilizer Type and Lime Application, Cost Reduction in Response to Fluctuating Sugar Market Prices, Proper Post-Harvest Cane Cleaning and Mechanized Farming. Therefore, the sugarcane industry the production of raw sugar in the 4th district of Iloilo, Philippines shows an upward growth and resilience despite various internal and external challenges, economic, governmental regulations, politics and adverse effects of climate change like strong typhoons and EL Niño.

Index Terms

Agricultural Economics, Sugarcane Industry, Farm And Milling, Crucial Strategies, Sustainability, Case Study, 4th District, Iloilo, Philippines

Using the Responsibility Transfer Teaching Model to Train Primary Caregivers of Children Aged 0–2 with Suspected Autism to Implement Natural Context Teaching Strategies

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The study explored the use of natural context teaching strategies by three primary caregivers during snack time at a family support center. While these strategies were effective in this setting, their application in parent-child activities and free play was limited. Home visits revealed that, except for one caregiver, the others struggled to generalize these strategies at home, with infrequent use. Challenges included socioeconomic factors and health issues affecting emotional stability. Despite these difficulties, all caregivers improved their interactive behaviors, becoming more sensitive and responsive to their children. The children's language communication also showed significant enhancement, with increased verbal exchanges and better engagement. Three months post-intervention, only one family continued using the strategies during free play, highlighting the need for tailored approaches considering family diversity. As the children's communication developed, some parents felt less need to create intentional learning opportunities. The findings indicate that early interventions must be adaptable to individual family needs and suggest further research to provide comprehensive support.

Index Terms

Children with Autism Spectrum Disorders; Gradual Release of Responsibility; Incidental Teaching

The Relationships Among Perceived Parental Overparenting and Perfectionism in High School Students

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This study investigates the relationship between parental overparenting and perfectionism among high school students in Nantou County, Taiwan. Utilizing a cluster sampling method, data were collected from 600 high school students, yielding 565 valid responses (94.2% response rate). Among the respondents, there were 245 males and 320 females, comprising 289 first-year, 165 second-year, and 111 third-year students, with 131 being only children. The results indicate a significant positive correlation between parental overparenting and perfectionism, consistent with existing literature. Specifically, heightened parental scrutiny regarding children's academic and personal lives correlates with increased perfectionistic tendencies, while granting autonomy appears to mitigate such tendencies. The social expectation model posits that elevated parental expectations are a fundamental source of children's perfectionism. Overparenting manifests through excessive concern and unrealistic expectations, compelling children to establish high standards while simultaneously engendering fears of failure and mistakes. Furthermore, the findings reveal a significant positive correlation between parental overparenting and psychological control. This relationship suggests that as the degree of overparenting intensifies, so does the level of psychological control exerted over children. Psychological control, characterized by intrusive parenting practices that foster dependency, includes excessive monitoring of academic performance and involvement in extracurricular activities. Moreover, psychological control is significantly correlated with perfectionism, indicating that increased psychological control contributes to the development of perfectionistic traits in children. The study identifies psychological control as a partial mediator between parental overparenting and perfectionism, elucidating the mechanisms underlying these interrelations. Overall, the findings underscore the detrimental impact of excessive parental intervention on children's psychological development, highlighting the necessity for balanced parenting strategies to promote healthy psychological outcomes.

Index Terms

Overparenting; Perfectionism; Psychological Control

Preliminary Validation of Origami Complexity Using an Information-theoretic Approach

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This paper provides a conceptual framework for an innovation model in the makerspace utilizing paper folding, specifically origami. Origami, as a low-cost, safe, and flexible paper folding technique, is chosen for this study due to its versatility across various subjects. The transformation of origami from an art form into an educational tool, research method, and business application is explored in this study to propose a new innovation model. This paper introduces an information-theoretic complexity metric for origami folding, aiming to answer the following questions: 1) How can the difficulty of origami be quantitatively measured using an information-theoretic approach? 2) Can this proposed metric be validated through human-subject studies? Data collected from human-subject studies, via observations, reveal that the proposed computational origami complexity is well validated through a Spearman's correlation test. Additionally, this study examines age and gender differences in origami activities, showing significant differences based on age but no notable difference based on gender. Further research is needed to explore how artificial intelligence and expanded human-subject studies may contribute to innovations in the assessment, prevention, and rehabilitation of mental and developmental disorders, such as ADHD, autism, and dementia.

Index Terms

Complexity, Information-Theoretic Approach, Origami, Paper Folding

Global Village and the Quest for a Metaphysical Home in the Select Works of Pico Iyer

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In an increasingly interconnected world, the boundaries of identity and belonging constantly shifting, shaped by the forces of globalization and cultural exchange. Siddharth Pico Raghavan Iyer, known as Pico Iyer through his travel writings vividly captures this transformation, portraying how modern individuals navigate a world where traditional notions of home are no longer fixed but fluid and evolving. Through his works, such as *Falling Off the Map: Some Lonely Places of the World* (1993), *Video Night in Kathmandu: Other Reports from the Not-So-Far East* (1998), *Sun After Dark: Flights Into the Foreign* (2004), *The Open Road: The Global Journey of the Fourteenth Dalai Lama* (2008), Pico Iyer explores the intersections of displacement, hybridity, mongrel identity and the universal quest for meaning. Iyer examines the hybridization of cultures, capturing moments where Western symbols like Hollywood and fast-food chains transform into aspirational meanings in Asian context. In *Falling Off the Map* he delves into the peculiar sense of isolation and connection found in overlooked or remote parts of the world, offering insights into the universal human desire for meaning and belonging. Similarly, with *Sun After Dark* Iyer ventures into the metaphysical aspects of travel, reflecting on how encounters with unfamiliar cultures can redefine one's inner landscape. The "global village" as conceptualized by Iyer, is not merely a physical phenomenon but a metaphysical home --- a space constructed through shared experiences, carrying within it the converging influences of multiple cultures, shaping the individual a 'mongrel' identity. Iyer vividly captures the paradoxes of globalization, illustrating how cultural markers are simultaneously familiar and foreign. The global village, internalized within individuals, becomes a metaphor for the complexities of contemporary identity --- a harmonious yet discordant blend of individuality and universality.

A Comparison of Evaluative that Clauses in the Abstracts of Nursing Research Articles in International and Japanese Nursing Journals

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This study investigates the frequency and forms of four evaluative elements—namely the evaluated entity, evaluative stance, source of evaluation, and evaluative expression—across 300 abstracts published in leading nursing research journals and Japanese nursing journals. The evaluated entity includes authors' appraisal of their own findings, previous studies, research aims, and the methods or theories employed, highlighting underlying notions of purpose, coherence, and value. Evaluative stance is conceptualized as the manner in which authors convey their attitudes through particular predicates, adopting either an attitudinal stance (reflecting affect or obligation) or an epistemic stance (assessing truth or accuracy). The source of evaluation is categorized into three types: human (authors or other researchers), abstract entities (e.g., data, spectrographs, or results), and a concealed origin (e.g., the pronoun "it"). Evaluative expressions can be verbal or non-verbal, with the latter—typically nouns or adjectives—being comparatively rare. Verbal expressions encompass research acts, discourse acts, and cognitive acts. Statistical analyses revealed significant differences in these evaluative strategies between abstracts in prominent nursing research journals and those in Japanese nursing journals. These findings are of particular relevance not only for EFL researchers, but also for novice scholars attending academic conferences for the first time, as well as for EFL instructors specializing in academic writing.

Deep Learning for Colorectal Lesion Segmentation in Colonoscopy Images

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Colorectal cancer represents a critical gastrointestinal disorder that poses a serious threat to life and has become a prominent global health issue, with concerning statistics regarding new cases and deaths reported in 2018. In South Korea, there has been a notable rise in colorectal cancer diagnoses over the last five years. A significant number of these cases go undetected due to the intricate nature of colorectal lesions, which presents a challenge even for seasoned healthcare practitioners. This research aims to utilize deep learning, particularly convolutional neural networks (CNNs), to improve the accuracy of colonoscopy image evaluations. The approach taken involved training the CNN model on an extensive dataset and refining it to attain high levels of accuracy in image segmentation. This method facilitates the automatic and precise detection of lesions, which is vital for accurate diagnosis and treatment strategies. The performance of the developed model was assessed both qualitatively and quantitatively using the CVC-ClinicDB dataset, which comprises 612 images. The model achieved a pixel level classification accuracy of 89% accuracy highlights the effectiveness of the deep learning methodology in enhancing colonoscopy image analysis and improving diagnostic results.

Index Terms

Colorectal Image Segmentation, Deep Learning, Lesion, Medical Image Analysis

Gender Equality Education Experimental Curriculum for Special Education Classes at High School in Taiwan

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This curriculum is designed to promote gender equality among high school students in special education settings. It aims to enhance students' understanding and attitudes towards gender equality through structured lessons and activities. Gender equality education is a facet of multiculturalism, encompassing diverse gender identities. It embodies the principle of equal educational opportunities, ensuring that individuals, regardless of gender, can develop their potential fairly without undue restrictions based on gender. According to scholar Banks, gender equality education is not only an ideal but also a reform movement and educational practice. Voorhees emphasizes that gender equality involves giving equal respect to all genders, while Grossman & Grossman advocate for treating everyone equally based on the principle of sameness. This study investigates the effectiveness of gender equality education experimental curriculum for special education classes over a four-month period, comprising thirty lessons. A quasi-experimental design was implemented, featuring an experimental group and a control group, each with 12 students. Based on these results, the study provides specific recommendations for curriculum design and suggests avenues for future research to further enhance gender equality education in special education settings.

Index Terms

Curriculum Development; Gender Equality Education; Special Education

Cost Model Development for Green Building Compliance with Indonesia's Regulation No. 21/2021

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Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21 of 2021 concerning Green Building Performance Assessment in obtaining Building Approval (PBG) and Functional Worthiness Certificate (SLF) is mandatory for buildings, but building stakeholders believe that green building investment costs are expensive. Through Soft System Methodology, which uncovers the problems that occur and then provides recommendations to obtain agreement through an expert panel with content validity index (CVI) analysis and questionnaires, five variables are obtained, namely conventional buildings, green buildings, value engineering, lifecycle cost analysis and cost performance with 26 dimensions, and 92 indicators in obtaining an effective cost model for green buildings processed with SEM Smart-PLS. It was found that the five variables of conventional buildings, green buildings, value engineering, life cycle cost analysis and cost performance influence each other, followed by 26 dimensions and 92 indicators which also have a significant impact and the equation $Y = 0.016 X1 + 0.182 X2 + 0.093 X3 + 0.683$ Lifecycle Cost is the highest influence which states that the initial cost of costs is based on building life cycle costs, green building construction costs only have a small impact on the value of the entire building when compared to non-construction costs. The results of this research will support the implementation of the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 21 of 2021 and make developers and property owners not only take into account the initial costs of building green buildings, as well as enable practitioners and academics to benefit from green buildings financially and educationally, productivity, energy and water resources, and global.

Research on the Effectiveness of Multimedia Computer-Assisted Instruction on Bullying Awareness in Elementary Students with Learning Disabilities

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Learning disabilities are conditions where individuals experience difficulties in fundamental skills such as listening, speaking, reading, writing, and arithmetic due to neuropsychological dysfunction. This often leads to challenges in academic performance and social-emotional issues. Academic difficulties can result in a diminished self-concept. Furthermore, students with learning disabilities exhibit higher rates of behavioral problems, substance abuse, and suicidal risk compared to their peers. Additionally, their self-efficacy and motivation for learning are often perceived as relatively low. Students with learning disabilities are often diagnosed by physicians around the first or second grade of elementary school. They typically exhibit characteristics such as attention deficit, hyperactivity, impulsivity, and difficulties with emotional regulation. As they progress to the upper grades of elementary school, their reckless behavior and manner of expression can lead to interpersonal conflicts, resulting in social exclusion or bullying. This research investigates the impact of multimedia computer-assisted instruction on enhancing bullying awareness among elementary school students with learning disabilities. Utilizing a single-subject research design with multiple probes, the study involved three participants and assessed effectiveness across baseline, intervention, and maintenance phases. Findings revealed that the multimedia instruction not only significantly improved immediate bullying awareness but also maintained its effectiveness over time. These results underscore the potential of technology-enhanced learning in fostering critical social awareness and suggest practical applications for educators.

Index Terms

Learning Disabilities; Multimedia Computer-Assisted Instruction; School Bully

Enhancing Alumni Information Systems with a Job Recommendation Feature

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With the rapid growth of online job portals, alumni often faced challenges in efficiently identifying suitable job opportunities due to the overwhelming number of search results and the limitations of traditional information retrieval techniques. This study introduced an enhanced alumni information system with an integrated job recommendation feature designed to address these challenges. The system aggregated job listings from multiple online platforms and employed personalized recommendation algorithms to match job opportunities with the profiles of registered alumni. A comprehensive evaluation of the system was conducted using the ISO 25010 software quality framework, involving 50 randomly selected pilot users. The results demonstrated exceptional performance across functionality, reliability, usability, efficiency, and portability, validating the system's effectiveness in meeting user needs. By providing a centralized, user-friendly platform, this enhanced system streamlined the job-seeking process for alumni and strengthened the connection between alumni and their alma mater. The findings of this study contributed to the advancement of alumni information systems and highlighted the potential for similar recommendation systems to support career development in educational institutions.

Index Terms

Alumni Information System, Career Development, Centralized Job Search, Job Recommendation System

Study on the Effects of Scaffolding Language Instruction on Language Abilities in Children with Autism

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Autism is a severe developmental disorder that manifests in early childhood, characterized by three key features: impairments in social interaction, verbal communication, and a narrow range of repetitive interests and behaviors. Various theories, such as deficits in psychological theory, executive function, joint attention, intentionality, central coherence, and emotional abilities, attempt to explain the core symptoms of autism; however, they do not account for all symptoms. Researchers are also exploring genetic factors, aiming for breakthroughs in treatment and prevention. This research investigates how scaffolding language instruction impacts the language skills of children with autism. Utilizing a single-subject, multi-probe design across various contexts, the study includes generalized probing and interviews as supplementary methods. The subjects comprise ten children with autism from regular kindergartens in Taichung City, Taiwan. They were randomly assigned to experimental and control groups, with five children in each group; however, one child from the control group dropped out due to relocation. The results demonstrate that scaffolding language instruction significantly improves learning outcomes for the experimental group compared to the control group, indicating a notable effectiveness of this teaching method. Interview findings reveal that both teachers and parents recognize the children's capacity to use acquired language skills in daily communication interactions, suggesting that scaffolding language instruction can facilitate meaningful engagement in social situations. Overall, the study highlights the potential benefits of tailored language instruction for young children with autism.

Index Terms

Autism; Children; Scaffolding Language Instruction

A Case Study on the Communication Functions of Non-Conventional Speech in Autistic Children

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Children with autism may engage in several forms of non-conventional language behaviors, including echolalia, where they repeat phrases inappropriately across contexts; immediate and delayed echolalia, where they verbatim repeat words from conversations; scripting, where they recite lines from songs or previous dialogues; and repetitive questioning, where they ask the same questions multiple times. While puzzling, these behaviors represent a primary mode of expression in the early language stages of autistic children, despite not conforming to traditional communication norms. Understanding the communication functions of these behaviors is crucial. Non-conventional language can express needs, facilitate social interactions, and enable participation in exchanges. This study aims to explore the types of non-conventional speech and communication functions in preschool-aged children. The findings reveal that both children primarily use general speech, indicating it as their main mode of expression. Approximately half of their non-conventional speech serves multiple communication functions, predominantly focusing on “maintaining interaction” and “seeking attention.” Echolalia is primarily used for interaction and self-reminders, while metaphorical language encompasses functions such as attention-seeking, commenting, avoiding protests, and expressing emotions. Additionally, repetitive questioning mainly functions to seek attention and request information. The factors influencing non-conventional speech are categorized into internal aspects, such as language ability and emotional regulation, and external elements, including curriculum content and teaching methods. Notably, the emergence of these speech types occurs at different ages, suggesting a developmental progression related to language skills. These insights provide a deeper understanding of communication strategies in high-functioning autistic children and can inform future interventions and educational approaches.

Index Terms

Autism; Metaphorical Language; Non-conventional Speech; Preschool-aged Children; Repetitive Questioning

Effect of iWrite-aided College English Writing Teaching and Evaluation System

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This study explores the implementation of the iWrite English Writing Teaching and Evaluation System in a college English course, focusing on its role as an experimental subject. Students are required to engage in self-directed learning using materials provided by the instructor before class, internalizing knowledge that will be discussed during lessons. This approach necessitates a high level of psychological awareness, allowing learners to evaluate, manage, and monitor their learning processes, thereby enhancing their metacognitive skills. The findings indicate that students exhibit an intrinsic motivation towards the system, actively engaging with its features. By effectively utilizing this platform, there is significant potential to enhance students' autonomous learning capabilities, facilitate the comprehensive construction of writing knowledge, and foster positive changes in their writing attitudes. The system not only provides structured feedback but also encourages students to take ownership of their learning process, leading to improved writing skills. Furthermore, the interactive nature of the iWrite system creates an engaging learning environment that supports collaborative learning and peer review.

Index Terms

iWrite English Writing Teaching and Evaluation System; Teachers' Online Support; Writing Instruction

Effect of Cooperative Learning on Reading Comprehension in Children with Hearing Impairments

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Reading comprehension is indeed a critical skill for academic success, especially for children with hearing impairments who encounter distinct challenges. Cooperative learning, which focuses on group work and peer interaction, can create a supportive learning environment that enhances understanding and retention of reading material. By collaborating with peers, these children can share insights, clarify concepts, and develop their communication skills, ultimately improving their reading comprehension and overall academic performance. The purpose of this study is to analyze the effect of cooperative learning on the reading comprehension abilities of children with hearing impairments. The research employs a single-subject design with alternating treatments to conduct the study. The subjects are two children with hearing impairments, who underwent four self-developed "reading comprehension tests" during the baseline phase. In the intervention comparison phase, they completed fifteen self-developed tests, followed by five tests in the final phase. The results were analyzed using visual analysis and C statistics of cooperative learning. Additionally, a standardized "Chinese Reading Comprehension Test" was administered before and after the teaching to objectively assess the participants' progress in reading comprehension skills.

Index Terms

Cooperative learning; Children with Hearing Impairments; Reading Comprehension

Effects of Storytelling Books to Enhance Young Children's Reading Comprehension through Interactive Teaching Method

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Reading is one of the ways humans acquire knowledge and is an essential activity for enriching one's spiritual life. Developing good reading habits should begin as early as possible. Early reading plays a significant role in the intellectual development of young children. The research highlights that ages three to eight are crucial for establishing independent reading skills and can enhance children's comprehension and narrative abilities. The most important medium for early reading is picture storybooks. Although young children may be limited by their literacy and life experiences, the visual appeal of these books can easily spark their interest in reading and expand their imagination and thinking space. This indicates that young children generally enjoy and do not reject reading. Maintaining their positive attitude towards reading is essential for laying the foundation for lifelong learning, with reading comprehension being a key component of this process. Unlike traditional teaching methods, interactive teaching shifts the teacher's role from being a complete authority to becoming an observer of children learning, providing support and assistance as needed. This study aims to explore the feasibility of using the interactive teaching method to enhance reading comprehension skills among preschool children in Hong Kong. A total of 64 kindergarten children aged five to six were randomly selected for the study. A quasi-experimental research design was employed, dividing the children into an experimental group and a control group. The study consisted of three phases: pre-test, experimental teaching, and post-test, followed by qualitative and quantitative analysis of the collected data. Based on the outcomes of the experimental teaching, the study identified ways to use picture storybooks as teaching materials and implement interactive teaching strategies to assist Hong Kong kindergarten teachers in practicing interactive teaching to enhance children's reading skills.

Index Terms

Children's Reading Comprehension; Interactive Teaching Method; Storytelling Books

Small Business E-Commerce Master Plan

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Indonesia is the country with the 4th largest internet users. People do not hesitate to use the internet as part of fulfilling their needs. E-Commerce is one of the media with the highest electability. Even though its reach is relatively large, there are still only a few regions in Indonesia that have utilized the sophistication of the internet. One of those interested in developing e-commerce is Makasar City and Bandung Regency. This article will formulate business processes in both loci by relying on the potential of natural resources, human resources and policy support in the region. The method, with a qualitative approach and descriptive method, is considered a vehicle for exploring data and information sourced directly from informants and business actors. The results of the research explain that the business process is to make e-commerce development a priority program in developing MSMEs, promote local culture by building e-commerce that will promote its culture through design layouts and logos and variations in business types, and not be afraid to carry out service trials. digital application. Thus, e-commerce is not only about promoting products, but most importantly it is about increasing access to attractiveness for investors in investing their business capital in potential business actors.

Index Terms

Masterplan, Innovation, Digitalization

Development of Sweet Potato Food Processing Training Plan for the Indigenous People of Albay

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This study presents the development of a training program aimed at enhancing food processing skills using sweet potatoes for the Indigenous People (IP) in Albay, Philippines. Recognizing sweet potatoes' significant nutritional and economic potential, this training plan seeks to empower indigenous communities by teaching them value-adding food processing techniques. The program emphasizes the local varieties of sweet potatoes, white, yellow-orange, and purple, and introduces traditional and modern processing methods, such as boiling, shredding, roasting, and candying, alongside unique recipes like flavored chips and purple sweet potato jam. Designed with community needs and sustainable practices in mind, the training promotes food security and economic resilience by equipping IPs with skills that foster local entrepreneurship. Outcomes from training plan indicate increased knowledge retention, improved product quality, and enhanced marketability of sweet potato-based products. This culturally adapted training plan supports IPs in diversifying their income sources while preserving their traditional agricultural practices, ultimately contributing to community well-being and sustainable economic development.

Index Terms

Training Plan, Indigenous People, Sweet Potato, Food Processing, Small Business

Research on the Integration of Modern Apprenticeship Systems and Educational Large Models: A Perspective Based on Literature Review and Case Analysis

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The modern apprenticeship system, which serves as a vital link between education and employment, faces challenges such as insufficient dual-teacher teaching capabilities, a limited assessment system, and communication barriers between schools and enterprises. To address these issues, Education Large Models (ELMs), powered by artificial intelligence, offer innovative solutions for reform. ELMs enhance teaching quality through personalized training, intelligent teaching assistance, and the creation of communication platforms for teachers, addressing disparities in teaching capabilities. For assessment, ELMs introduce dynamic, diverse, and personalized evaluation metrics, improving the scientific accuracy of apprenticeship evaluations and overcoming the limitations of traditional methods. Furthermore, ELMs establish a unified platform to bridge the communication gap between schools and enterprises by intelligently interpreting industry needs and educational feedback, facilitating effective collaboration. A notable example of this is the partnership between Huawei and Xi'an University of Electronic Science and Technology, where ELMs have been used to improve both soft skills and technical knowledge among apprentices. However, challenges remain, such as data privacy concerns and algorithmic bias. Future research should focus on enhancing data security measures, addressing algorithmic fairness, and developing accessible technological solutions to broaden the applicability of ELMs across various educational contexts. By overcoming these challenges, ELMs will drive the intelligent transformation of the apprenticeship system, ensuring a sustainable approach to cultivating high-quality skilled talent.

A Study on Students' Learning Behaviors Using E-learning Platforms: A Case Study of the BB Online Classroom

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The e-learning platform has transformed many people's daily habits and significantly increased access to knowledge. Numerous corporations have invested in the development of e-books, allowing us to read these books on any computer with internet access. It is possible that one day, attending traditional schools may become obsolete, as we could complete our education entirely online. In recent years, a variety of e-learning packages have been developed through academic research and business innovation, and these have been implemented in many educational organizations. Despite the long-standing presence of e-learning, we still lack a clear understanding of its impact on learning outcomes and student behaviors in an online environment. This paper aims to investigate the usage patterns on an e-learning platform to uncover student learning behaviors. We will examine a specific case study involving the BB Internet classroom, utilizing data mining techniques to extract significant insights from learning portfolios. Additionally, we will compare how professors teach the same subject across different classes and whether their use of curriculum documents varies. Statistical analysis will be employed to determine if there are any significant differences. Ultimately, we seek to identify key variables in the classroom to provide valuable references for the BB Internet classroom.

Index Terms

Data Mining; E-learning; Learning Behaviors

Reducing the Carbon Footprint: Sustainable Lithium Battery Recycling Strategies for the Electric Vehicle Supply Chain

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Lithium batteries in electric vehicles, focusing on environmentally sustainable principles and their implications. The transition to green energy is rapidly gaining momentum, with hybrid cars playing a crucial role in this shift. Nonetheless, the favored theory of battery production faces significant challenges, including the necessity for cobalt, nickel, and lithium. Examining greenhouse gases linked to these activities occurs alongside analyzing the environmental damage inflicted by mining, including ecosystem disruption, water contamination, and soil degradation. The article explores sustainability challenges, outlining emission limits while optimizing output. It also delves into the intricate policies necessary for achieving economic development, social justice, and ecological integrity. The article outlines various strategies to reduce these impacts, such as advancements in mining technologies, improved recycling techniques, and strong policy suggestions to encourage sustainable mining practices. The analysis also evaluates current regulations and their efficacy in promoting sustainability, proposing enhancements to align environmental and economic objectives better. The article explores future developments in hybrid battery technology, the possibilities of alternative materials, and the importance of interdisciplinary strategies to tackle sustainability issues. The article emphasizes the need for stakeholders to focus on sustainable practices within the hybrid battery supply chain, highlighting the critical balance between environmental impact and greenhouse gas emissions to foster a more sustainable future.

Index Terms

Carbon Footprint, Battery Recycling, Environmental Harm, Sustainability

Physical and Mechanical Properties of Cement-Based Skim Coat utilizing Limestone from Northern Mindanao, Philippines as Filler Material

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Cement-based skim coat is a vital material for residential and commercial wall and ceiling applications. Its growing demand can be attributed to the increasing preference for energy-efficient and sustainable construction practices, which prioritize environmentally friendly materials such as paints and coatings. A key ingredient in skim coat production is limestone, commonly used as a filler material. To enhance productivity and cost-effectiveness, efforts have been made to identify locally available sources of limestone. This study investigates the potential of limestone from Northern Mindanao as a filler material in cement-based skim coat production. The limestone was analyzed, and skim coat samples were produced at varying limestone-to-cement ratios, particle sizes, and water demands. The study evaluated the effects of these factors on the ease of mixing, workability, setting time, trimming, adhesion, and compressive strength of the skim coat. Results revealed that the limestone from Northern Mindanao, with a calcium carbonate (CaCO_3) content of 93.3%, is a suitable filler material, as evidenced by the physical properties of the skim coat. Additionally, the samples met the standard specification of compressive strength for skim coat materials. These findings highlight the significant potential of Northern Mindanao limestone in cement-based skim coat production.

Design and Development of a Portable Static Stability Training System

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This study presents the design and development of a portable static stability training system that integrates a custom-built Inertial Measurement Unit (IMU) and an interface program. The system provides a practical, cost-effective alternative to traditional balance measurement devices such as force plates (FP), which are expensive and confined to laboratory settings. By analyzing acceleration data on three directions, the IMU assesses body sway, enabling real-time feedback for users to improve stability. This makes it suitable for applications in sports training and rehabilitation. Data was collected from five participants performing three postures: standing on two feet, heel-to-toe, and one foot. Correlation analysis showed a strong relationship between FP Center of Pressure (CoP) data and IMU sway path in direction x and y, respectively. The interface program developed using Windows Forms App (.NET Framework) in Visual Studio 2022, enhances user experience by monitoring the CoP and Base of Support (BoS). When the CoP extends beyond the BoS, the system provides immediate feedback, prompting posture adjustments to regain balance. This portable system provides a hands-on, accessible approach to static stability training, enhancing accessibility for use in various settings.

Learning Strategies Integrating Technology to Create Efficient Maths Learning

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This study examines the trends and key findings of effective technology strategies integrated into mathematics learning based on data from international publications. Educational technology in mathematics learning is an innovation designed to create a more interesting and interactive learning design. This interesting design is expected to be able to increase students' enthusiasm and focus in learning mathematics. This study aims to describe the effectiveness of various technology integration strategies in mathematics learning and their impact on improving the quality of learning. The method used is the systematic literature review (SLR), with the aim of identifying, reviewing, and evaluating relevant research that answers the research questions that have been set. The stages of the study include formulating questions, searching for literature, selecting literature, presenting data, and drawing conclusions. The results of the study indicate that the application of technology to mathematics learning in the classroom using various digital applications, e-learning, and technology-based learning models is an effective strategy and has a positive impact on the effectiveness of mathematics learning. These positive impacts include improving mathematical communication skills, increasing motivation, learning outcomes and achievements, better critical thinking skills, and higher interest in learning mathematics. These findings indicate that educational technology can be applied in mathematics learning to support improving student competencies at various levels of education.

Index Terms

Technology, Education, Mathematics Learning

Integrated Technology Innovation in Arts Learning to Face Future Challenges

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Integrated technological innovation in art learning plays an important role in answering the challenges of education in the digital era and the future. The integration of technology in art enables the creation of interactive, flexible, and adaptive learning methods to changes in needs and socio-cultural dynamics. This study aims to identify and analyze technological innovations applied in the art learning process and their impact on the development of students' creativity and skills. With a literature review approach, this study reviews various technologies such as augmented reality (AR), virtual reality (VR), and AI-based applications that have been applied in art learning. The results of the study show that the use of technology can increase interest in learning, facilitate aesthetic exploration, and expand access to various forms of art. In addition, technology also enables personalization of learning that encourages students to experiment and innovate. Thus, the challenges in implementing technology include the availability of infrastructure, teacher readiness, and the need for curriculum adaptation. Therefore, collaborative efforts are needed between educational institutions, the government, and the technology industry to create an ecosystem that supports technology-based art learning. This innovation is expected to be able to form a creative, critical, and adaptable generation amidst global technological advances.

Index Terms

Technology, Education, Art Learning

Accessing Vocational Education for Out-of-School Myanmar Migrant Youths in Mae Sot, Thailand

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This research study is about the out-of-school Myanmar migrant youths and their access to the vocational education in Mae Sot district of Thailand by employing '4As framework' for Education with the indicators of availability, accessibility, acceptability and adaptability. In this thesis, out-of-school Myanmar migrant youths are understood as those who have left education without receiving formal qualifications, and who are beneath the age of 21. The population of the Myanmar migrant youths has been significantly growing everyday due to the unrested conditions all around Myanmar. Among them, there are thousands of youths who are struggling to access to any type of educational pathways because of their academic background, financial status or legal status. This research investigates the barriers the out-of-school Myanmar migrant youths face in accessing the vocational education and provide some practical recommendations for organizations, migrant communities and the host society to be able to promote educational opportunities for the out-of-school migrant youths. This is a development concern not only to the youths and the Myanmar migrant communities, but also to the hosting Thai society because all the communities are connected through job market, environment and social security concerns.

Teachers' Perception toward the Implementation of Independent Teaching Platform in English Language Teaching

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In February 2022, the Ministry of Education and Culture developed a new policy with a new platform, namely the independent teaching platform. Technology has many positive impacts on learning. The aim of this research is to investigate Teachers' Perception toward the Implementation of Independent Teaching Platform in English Language Teaching. This research conducted at English teacher working group at Bengkulu Tengah. The methodology of this research is mixed method (quantitative and qualitative research). Data collection of this research used the questionnaires and interview. The data analyzed with using qualitative and quantitative approach. The result of this study is 80, 3 % teachers agree with Independent teaching platform that encourage that is beneficial viewpoints and it showed potential implications for education and the improvement of teacher professional development especially in English language teaching. The features of Independent Teaching Platform can give more impact into the learning environment and can create their lessons and teaching materials more creative and innovative. The teachers hope the independent teaching platform more complete with other features and this application can be access by student not only for teachers.

Index Terms

Perception, Independent Teaching Platform, ELT, English Teacher

Prioritizing Profitability: The Breakeven Point as a Keystone for Women Entrepreneurs

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Despite the wealth of knowledge available in financial textbooks and academic curricula, the critical importance of break-even point (BEP) determination and analysis is often overlooked in financial literacy training programs targeted at women entrepreneurs. This oversight has resulted in limited awareness and understanding of BEP as a tool for financial decision-making, contributing to challenges in achieving and sustaining profitability. This paper examines the gap between the theoretical knowledge of BEP and its practical application among women entrepreneurs. It argues that the underemphasis on BEP analysis in financial literacy initiatives undermines the ability of women entrepreneurs to make informed pricing, cost management and investment decisions. By synthesizing existing literature and analyzing case studies, the paper highlights the implications of this gap and proposes actionable strategies for integrating BEP analysis into financial training programs. Addressing this deficiency is essential for empowering women entrepreneurs with the financial acumen necessary to navigate competitive markets and achieve sustainable business growth. This study calls for a paradigm shift in the design of financial literacy curricula to include practical and context-specific training on BEP analysis, ensuring that women entrepreneurs are equipped with the tools to enhance profitability and resilience in their businesses.

Enhancing English Language Mastery by Cambridge Syllabus in Secondary School: The Significance of Independent Curriculum Implementation

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Independent Curriculum which is officially implemented in Indonesia has significantly opened more opportunities to all teachers in order to design teaching-learning activities adjusted to students' convenience in learning process. This methodological article discusses the implementation of Independent Curriculum in order to enhance English Language Mastery by integrating and developing Cambridge syllabus in SMA Unggul Del. This paper targeted grade X who has been running the Independent Curriculum started in academic year 2023/2024. Consequently, this methodological review was based on qualitative analysis by distributing questionnaires to students (grade X) regarding their personal experiences in using Cambridge syllabus. Thus, it is found that students achieved more progresses in mastering English language due to its myriad resources and activities which could help them advance their English abilities. The presence of digital pack provides more advanced activities in speaking, reading, listening and writing. They are all adjusted to contextual activities which can assist the learners to study individually. In addition, through presentation kit and online workbook, the learners are triggered to watch the video about the essential materials.

Index Terms

Independent Curriculum, Cambridge Syllabus, Digital Pack, Questionnaires

Geo-Morphology and Resource Inventory of Watersheds for Sustainable Land Use Cagayan De Oro City, Mindanao, Philippines

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With water and land as the most essential natural resources, it is important to utilize them properly. One of the key steps in proper utilization is knowing which resources should be prioritized as they are limited especially with the Philippine's growing population. Among these resources, are the watersheds, particularly the one found surrounding the Cagayan de Oro River basin. These watersheds are the intersection of the land and water bodies, thus determining how erodible the watershed's landscape truly is. Utilized in this study, is the use of geo-morphological parameters for better comprehension and planning in the watershed management. These geomorphological parameters can be used without referencing the soil chart for prioritization of the watershed in Cagayan de Oro. This prioritization of a watershed is used to determine which areas are critically disturbing the natural ecosystem of an area. Evaluation of these critical spaces in watersheds, and the sub-watershed are an important parameter. These critical spaces often dictate the suitable use of the land, risk of flood and susceptible to erosion. Thus the more critical the sub-watershed, the more it should be prioritized for proper land use and planning, especially for the watersheds in Cagayan de Oro River basin.

A Current Status of the Development of China's Logistics Small and Medium Enterprises Based on CiteSpace

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Small and medium enterprises (SMEs) are an important mechanism for economic growth in the current and new era, the technological innovation, and the main driving force for high-quality industrial development. This paper reviews the current status of the development of China's logistics SMEs from 2012 to 2024, and uses CiteSpace software for visualization analysis. The analysis shows that the current development of China's logistics SMEs mainly focuses on performance and management. According to the visualization analysis results of literature research hotspots and cutting-edge trends, future research will involve digital transformation and other directions.

Index Terms

Logistics SMEs; CiteSpace; Performance; Management; Digital Transformation; Visual Analysis

A Theoretical Development of Robotics Technology Pedagogical Approach (RTPA) in Mathematics Education

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Robotics and mathematics are deeply intertwined fields, with mathematics serving as the backbone for many aspects of robotics. This Explanatory Sequential Design (ESD) research aims to establish a Robotics Technology Pedagogical Approach (RTPA) as a theory in Mathematics Education. The RTPA Training Manual was designed and developed to provide a diverse pedagogy in teaching Mathematics using ADDIE Model. Thirty (30) Mathematics Teachers were purposively selected through inclusion criteria. The RTPA training-workshop integrated Arduino IDE for programming microcontrollers, Tinkercad, and Creality for 3D printing technology on mathematics topics such as algebraic expression, arithmetic and geometric sequences, simulator scientific calculator, protractor, measurement, and 3D polygons. The participants answered the proficiency test and in-depth interview after the training. Based on the formulated Mathematical Learning Model, the researcher established an RTPA Theory. Based on the formulated Mathematical Learning Model, the Robotics Technology Pedagogical Approach Theory is an interdisciplinary approach that aims to stimulate curiosity and computational thinking of learners to enhance 21st-century skills, promote higher-order thinking skills, improve problem-solving and mathematical skills, and increase numeracy skills and critical thinking skills in mathematics. Since RTPA activities are interesting, engaging and useful in class, Mathematics teachers can use this approach for hands-on learning, interactive drills and boost mastery, interdisciplinary connections, real-world applications in mathematics and provide authentic assessment. Integrating robotics technology into mathematics education in a theoretically grounded manner can enhance learning outcomes and foster students' mathematical understanding and problem-solving skills. With this, educators can design robotics-based math activities grounded in pedagogical principles and promote meaningful learning experiences.

Index Terms

Robotics Technology, RTPA, Mathematics, Grounded Theory

Design and Development of a Portable Static Stability Training System

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This study presents the design and development of a portable static stability training system that integrates a custom-built Inertial Measurement Unit (IMU) and an interface program. The system provides a practical, cost-effective alternative to traditional balance measurement devices such as force plates (FP), which are expensive and confined to laboratory settings. By analyzing acceleration data on three directions, the IMU assesses body sway, enabling real-time feedback for users to improve stability. This makes it suitable for applications in sports training and rehabilitation. Data was collected from five participants performing three postures: standing on two feet, heel-to-toe, and one foot. Correlation analysis showed a strong relationship between FP Center of Pressure (CoP) data and IMU sway path in direction x and y, respectively. The interface program developed using Windows Forms App (.NET Framework) in Visual Studio 2022, enhances user experience by monitoring the CoP and Base of Support (BoS). When the CoP extends beyond the BoS, the system provides immediate feedback, prompting posture adjustments to regain balance. This portable system provides a hands-on, accessible approach to static stability training, enhancing accessibility for use in various settings.

Writing Anxiety Faced by Postgraduate Fast-Track Students

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Academic writing demands the university students to write a particular topic by using English in academically. Since there are some aspects which should be considered in academic writing, it can arise some challenges. These challenges arise because English is not their native language and they should follow the language style of their foreign language. These challenges can arise writing anxiety. One of the types of academic writing is English journal article. The aims of this research are to find out writing anxiety and its causes. This research is descriptive quantitative method. The population is 7 fast-track students of postgraduate program of English education in University of Bengkulu. The researcher used total sampling technique, so the total respondents was seven students (3 females and 4 males). The researcher used Second Language Writing Anxiety Inventory (SLWAI) and Writing Anxiety Inventory (CWA) theory. The results are the dominant type of writing anxiety is avoidance (mean:3,57), somatic (mean:3,43), and cognitive (mean:3,16). The primary causes of writing anxiety are high frequency of writing, time pressure, language difficulties, low self-confidence, and fear of writing test. The conclusions are there are three types of writing anxiety and ten causes of the writing anxiety which are faced by fast-track students.

Index Terms

Writing Anxiety, Causes, Academic Writing

Cultural and Religious Dynamics of Hoyak Tabuik: Exploring Socio-Economic Impacts in Pariaman through a Phenomenological Lens

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Hoyak Tabuik is a tradition of the Minangkabau people in Pariaman City, passed down through generations to commemorate the death of the grandson of Prophet Muhammad SAW, namely Hussein bin Ali, on the 10th of Muharram each year. The celebration coincides with the Day of Ashura, following the beliefs of Shia Muslims worldwide. However, Hoyak Tabuik has undergone adaptations, as the majority of Pariaman's population follows Sunni Islam, transforming the tradition into a cultural celebration imbued with local Minangkabau wisdom. In addition to its religious and cultural values, Hoyak Tabuik also has socio-economic impacts on the local government of Pariaman City. This research employs a qualitative method with a phenomenological approach. Primary data is gathered from in-depth interviews with the people of Pariaman, while secondary data is sourced from books, articles, or online resources discussing Hoyak Tabuik. The objective of this study is to explore the religious and cultural values embedded in the Hoyak Tabuik tradition and examine its socio-economic impacts on the Pariaman community.

Unleashing the Rural Charm: A Multidimensional Approach for Farm Tourism as Driver for Northern Mindanao Competitiveness (Improving Bukidnon Tourism Competitiveness through Farm Tourism)

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This study investigates the role of farm tourism as a driver of competitiveness in Northern Mindanao, with a focus on Bukidnon. Farm tourism integrates agriculture and tourism, fostering economic diversification, community engagement, and environmental sustainability. A mixed-methods approach was employed, combining surveys, interviews, and stakeholder consultations across Northern Mindanao's provinces to evaluate the contributions of farm tourism. The research examines its impacts across economic, social, and environmental dimensions, revealing its role in creating employment, preserving cultural heritage, and promoting sustainable practices such as eco-friendly resource use and waste management.

Despite these benefits, challenges persist, including inadequate infrastructure, limited community engagement, and gaps in safety practices. Recommendations include enhanced government support, robust marketing strategies, and community-based tourism models to overcome these barriers. This study provides actionable insights for policymakers, farmers, and stakeholders to unlock farm tourism's potential for sustainable rural development, cultural preservation, and economic resilience in Northern Mindanao.

Index Terms

Farm Tourism, Bukidnon, Mixed-Methods, Sustainability, Rural Development, Community Engagement, Economic Diversification, Eco-Friendly Practices

Liver and Tumor Segmentation Using Convolution Neural Network

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The process of clinical visualization involves the identification and segmentation of liver tumours. This is essential for accurate diagnosing, treatment planning, and disease surveillance. In this study, we investigate and compare three contemporary convolutional neural network (CNN) architectures—U-Net, DenseNet, and ResNet—for liver tumour segmentation in CT scans. Each model was trained and evaluated on a dataset containing annotated liver CT images, concentrating on accuracy, Dice coefficient, Intersection over Union (IoU), precision, and recall metrics. Among the six test samples used for evaluation purposes, U-Net architecture displayed superior overall performance with an average Dice coefficient of 94.4%, IoU of 89.2%, precision of 93.4% as well as recall rate of 95.7%. Average Dice coefficient for DenseNet that uses densely connected convolutional layers was 92.5%, while the IoU was recorded as 86.7%, precision – 91.9% and recall – 94.0%. Deep residual learning framework in ResNet yielded competitive results with median DICE coefficient at 91.4%, IoU at 85.3%, Precision at 90.6% and Recall at 93%.

Index Terms

Liver Tumour Segmentation, Convolutional Neural Networks (CNNs), U-Net, DenseNet, ResNet, Medical Imaging, Intersection over Union (IoU)

An IoT-Based Approach for Air Quality Monitoring and Forecasting Using GRU Networks

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As pollution levels continue to rise, both urban and rural areas face significant environmental and public health challenges, making air quality monitoring a critical global priority. Air pollution impacts ecosystems, human health, and the climate, necessitating continuous monitoring. This paper addresses the problem of predicting real-time air quality levels using IoT-based solutions. Various IoT sensors, including MQ9, MQ7, MQ135, MQ131, DHT11, and SDS011, are employed to collect data on key parameters such as Carbon Monoxide (CO), Carbon Dioxide (CO₂), Ozone (O₃), Ammonia (NH₃), Benzene, PM_{2.5}, Methane, Temperature, and Humidity. A pre-trained Gated Recurrent Unit (GRU) model is utilized to analyze the data and predict air quality levels based on the Air Quality Index (AQI). Additionally, a chatbot is integrated to provide responses to user queries related to air quality. The proposed system effectively predicts air quality levels, providing a valuable tool for addressing pollution-related challenges.

Index Terms

Real-Time Prediction, Air Quality Index (AQI), Internet of Things (IoT), Real-Time Data, Gated Recurrent Unit (GRU) Model, Environmental Health

Detection of Malware in Android Systems using Machine Learning Algorithms

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This research article explores the detection of malware in Android systems using various machine learning algorithms. With the increasing prevalence of Android devices, the risk of malware attacks has escalated, posing significant threats to user data, privacy, and device functionality. The study leverages permission-based detection methods, where applications must request access to system features and user data, to identify potential malicious activities. By employing both static and dynamic analysis techniques, the research aims to enhance the accuracy and efficiency of malware detection. The article evaluates the effectiveness of machine learning classifiers such as Random Forest, Support Vector Machines (SVM), Decision Trees, K-Nearest Neighbours (KNN), and Logistic Regression, as well as deep learning models like Neural Networks and Convolutional Neural Networks (CNNs). The study also incorporates feature selection techniques to optimize the detection process, ensuring high accuracy while minimizing computational overhead. The proposed detection system is tested on a comprehensive dataset of Android applications, categorized as either malicious or benign based on various behavioural and permission-based indicators. The results demonstrate that the combination of machine learning and deep learning techniques significantly improves the detection rates of Android malware. The article highlights the importance of feature selection and preprocessing in enhancing model performance and reducing false positives. Additionally, the research discusses the practical implementation of the detection system, including the development of a web-based interface for real-time malware detection. The findings underscore the potential of machine learning algorithms in providing robust and scalable solutions for Android malware detection, contributing to the overall security and reliability of mobile devices.

Index Terms

Android Malware Detection, Machine Learning Algorithms, Permission-Based Detection, Static Analysis, Dynamic Analysis, Random Forest, Support Vector Machines, Neural Networks, Feature Selection, Mobile Security

Optimized CNN with Sparrow Search Algorithm for Early Pancreatic Cancer Detection

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Medical image analysis for pancreatic cancer (PC) classification and recognition is a vital domain of research and medical practices. PC is challenging to diagnose and treat; medical imaging approaches aid early diagnosis to analyse and treat, and employ of medical imaging approaches are support early diagnosis, correct analysis, and treatment planning. Computed Tomography (CT) scans are generally utilized to detect and classify PCs. Deep learning (DL) approaches have demonstrated the ability to support the diagnosis and detection of several medical conditions, containing PC. Convolutional Neural Networks (CNNs) are a kind of DL approach generally employed for image analysis that is trained to automatically learn and extract features in medical images. So, this study purposes a new Sparrow Search Algorithm with Stacked Deep Learning based Medical Image Analysis for Pancreatic Cancer Detection and Classification (SSASDL-PCDC) technique on CT images. The purpose of the study is to design an SSASDL-PCDC technique to achieve improved pancreatic cancer detection performance. In addition, the SSASDL-PCDC technique applies Harris Hawks Optimization (HHO) with a densely connected networks (DenseNet) model for the feature extraction process. Moreover, convolutional neural network with bi-directional long short-term memory (CNNBiLSTM) approach was utilized for PC detection and classification. Furthermore, Sparrow Search Algorithm (SSA) is used to adjust the hyperparameter values of the CNN-BiLSTM technique. To evaluate the effectiveness of the SSASDL-PCDC technique, extensive experiments were executed on a comprehensive database of pancreatic CT images. The simulation outcome value depicted that the SSASDL-PCDC technique with maximum sensitivity of 99.26%, specificity of 99.26%, and accuracy of 99.26%.

Index Terms

Pancreatic Cancer, Computed Tomography Images, Sparrow Search Algorithm, Medical Image Analysis, Cancer Diagnosis

Stress and Welfare Assessment for the Livestock in Rural Areas by using IoT with Deep Learning and Neural Networks

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This research explores the application of deep learning algorithms to assess stress and welfare in livestock within rural areas. Livestock farming is a critical component of rural economies, yet stress and welfare issues can significantly impact animal health and productivity. Traditional methods of monitoring livestock welfare are often labor-intensive and subjective, leading to inconsistent and delayed responses to stress indicators. By leveraging advanced IoT devices and machine learning techniques, this study aims to provide a comprehensive understanding of livestock behavior and health, ultimately improving animal welfare and farm productivity. The integration of IoT devices, such as wearable sensors and environmental monitors, allows for real-time data collection on vital signs, behavior, and environmental conditions. Deep learning algorithms, including convolutional neural networks (CNNs) and recurrent neural networks (RNNs), are employed to analyze this data and identify patterns indicative of stress and welfare issues.

The findings demonstrate the potential of deep learning algorithms to revolutionize livestock welfare assessment in rural areas. The deep learning models achieved high accuracy in detecting stress-related behaviors and physiological changes in livestock, providing valuable insights into periods of high stress and correlating them with specific environmental and management factors. The study also highlights the significant impact of environmental conditions, such as extreme temperatures and poor ventilation, on livestock stress levels. By automating the monitoring process, farmers can receive real-time insights into animal health and take proactive measures to reduce stress. This research underscores the importance of integrating modern technology with traditional farming practices to enhance livestock welfare, leading to better productivity and economic outcomes for rural farmers.

Index Terms

Livestock Welfare, Stress Assessment, Deep Learning, IoT, Rural Farming, Wearable Sensors, CNN, RNN, Environmental Monitoring, Animal Behaviour

Leveraging Quantum Computing for Optimizing Minimal Spanning Tree Algorithms

Srinivasa Reddy Kummetha

A spanning tree in graph theory is a subgraph of a connected graph that includes all the vertices of the original graph but only enough edges to form a tree. A tree is a special type of graph that is connected and contains no cycles, which means there is exactly one path between any two vertices. In a spanning tree, the number of edges is always one less than the number of vertices. For a graph with V vertices, the spanning tree will contain $V-1$ edges. Spanning trees are crucial in various applications, especially in network design, where the goal is to connect all nodes with the fewest possible edges, ensuring efficiency and minimizing redundancy. A graph can have multiple spanning trees, especially in a complete graph, where every pair of vertices is connected by an edge. In weighted graphs, spanning trees are often used as the basis for finding the minimum spanning tree (MST), where the total weight of the edges is minimized. Algorithms like Kruskal's and Prim's are designed specifically to find the MST. Spanning trees are also important in distributed computing and network routing, as spanning tree protocols help prevent loops in communication paths between devices. Additionally, Depth-First Search (DFS) and Breadth-First Search (BFS) algorithms can be employed to generate spanning trees, offering different traversal strategies. Overall, spanning trees are essential in graph theory because they simplify the structure of a graph while maintaining its connectivity, providing the foundation for many other algorithms and applications. Kruskal's algorithm is a greedy algorithm used to find the minimum spanning tree (MST) of a graph. It works by sorting all the edges of the graph in non-decreasing order of their weights and then adding edges one by one to the spanning tree, ensuring that no cycles are formed. The algorithm uses a union-find data structure to efficiently check if adding an edge would form a cycle. It continues adding edges until the tree spans all the vertices. The time complexity of Kruskal's algorithm is $O(E \log E)$, where E is the number of edges, due to the sorting step. Using a union-find structure with path compression and union by rank reduces the complexity of the cycle-checking step to near constant time, making the overall complexity dominated by the edge sorting step. This paper addresses the implementation of spanning tree using quantum computing which will reduce the time and space complexities.

Index Terms

Cycle, Graph, Vertex, degree, Adjacency list, Adjacency matrix, Clique, Planar Graph, Eulerian Path, Spanning Tree

INTRODUCTION

Graph theory is a crucial area of study within mathematics and computer science, focusing on the analysis of graphs [1], which are structures composed of nodes (or vertices) and connections (or edges). Graphs are widely used to represent relationships and interactions in various practical scenarios. Typically, a graph is denoted as $G = (V, E)$, where V represents the set of nodes and E represents the set of connections. In directed graphs (digraphs), the connections have a direction, indicating a one-way relationship from one node to another. A complete graph

[2] is a specific type where every pair of nodes is connected by an edge. A bipartite graph divides its nodes into two separate sets, with edges only occurring between nodes from different sets. The degree [3] of a node refers to the number of edges attached to it. In a directed graph, the degree is divided into two parts: in-degree (the number of incoming edges) and out-degree [4] (the number of outgoing edges). One common method for representing a graph is using an adjacency matrix, where each entry shows if a pair of nodes is connected. Paths and cycles [5] are central concepts in graph theory. A simple path is one

where no node is visited more than once. The shortest path problem is concerned with identifying the path between two nodes that minimizes the total weight of the edges. A spanning tree of a graph is a subgraph [6] that includes all the vertices of the original graph and forms a tree. A tree is a connected, acyclic graph, meaning it has no cycles, and there is exactly one path between any two vertices. A spanning tree contains exactly $V-1$ edges, where V is the number of vertices in the graph. This ensures that the tree spans all the vertices, while minimizing the number of edges required to maintain connectivity. Every connected graph [7] has at least one spanning tree, and there can be multiple different spanning trees for a given graph. Spanning trees are used in various applications, such as network design and optimization algorithms.

LITERATURE REVIEW

Graph theory is a branch of mathematics and computer science that deals with the study of graphs, which are structures composed of vertices (or nodes) and edges (or links). Graphs are used to model a wide range of systems in which the entities are connected in some way. These connections are represented by edges, and the entities are represented by vertices. Graph theory is applied to various real-world problems such as network design, social networks, transportation systems, and more. A spanning tree [8] is an essential concept in graph theory, defined as a subgraph of a connected graph that includes all the vertices of the original graph with exactly $V-1$ edges, where V is the number of vertices. This ensures that the tree connects all vertices, while maintaining a simple structure without any cycles. Spanning trees are crucial for finding the minimum spanning tree [9] (MST), which is a spanning tree where the sum of the edge weights is minimized. Kruskal's algorithm [10] and Prim's algorithm are two common greedy algorithms used to find the MST. Kruskal's algorithm works by sorting all the edges of the graph in increasing order of their weights and then adding edges to the MST while ensuring no cycles are formed. This algorithm uses a union-find data structure to efficiently detect cycles and ensure the correct edges are added to the MST.

The time complexity of Kruskal's algorithm is $O(E \log E)$, where E is the number of edges, dominated by the sorting step. On the other hand, Prim's algorithm [10] starts from an arbitrary vertex and grows the MST by repeatedly adding the smallest edge that connects a vertex in the tree to a vertex outside of it. Prim's algorithm is typically more

efficient for dense graphs and can be implemented using a priority queue to select the minimum-weight edge at each step, achieving a time complexity of $O(E \log V)$, where V is the number of vertices. Both algorithms guarantee that the final tree will have the minimum possible weight, but the choice of algorithm depends on the graph's characteristics. In sparse graphs, Kruskal's algorithm tends to be more efficient, while Prim's algorithm is better suited for dense graphs. Minimum spanning trees are widely used in various fields, such as network design, to minimize the cost of connecting multiple points, or in cluster analysis to group similar data points. Other important concepts in graph theory include shortest paths, bipartite graphs, planar graphs, and graph traversal algorithms like breadth-first search (BFS) and depth-first search (DFS). These algorithms and graph-related concepts have broad applications in fields ranging from computer networking to data structure optimization.

In addition to spanning trees, graph theory also encompasses a variety of other important concepts that help in understanding the structure and behavior of networks. One such concept is graph connectivity, which refers to the degree to which vertices in a graph are connected by edges. A connected graph is one in which there is a path between any two vertices, while a disconnected graph contains multiple disconnected components. The concept of connected components is useful for analyzing networks where different sections may not be directly connected. Another key concept is graph cycles, which are paths that start and end at the same vertex without repeating any edges. Cycle detection is critical in various applications, including deadlock detection in computer systems or identifying feedback loops in control systems. A bipartite graph is a special type of graph where the set of vertices can be divided into two disjoint sets, and edges only exist between vertices in different sets.

This structure is useful in matching problems, such as job assignments or network flows. Eulerian paths and Hamiltonian paths are other significant topics in graph theory. An Eulerian path traverses each edge exactly once, while a Hamiltonian path visits each vertex exactly once. These concepts are important in problems like routing and scheduling, where it is required to visit each edge or vertex under certain constraints. Graph theory also plays an essential role in the study of graph coloring, where the goal is to assign colors to vertices such that no two adjacent

vertices share the same color.

The chromatic number of a graph is the minimum number of colors needed to color the graph. This concept is widely used in problems like register allocation in compilers or scheduling tasks. In network flow problems, graph theory is instrumental in finding the maximum flow between a source and a sink in a flow network. Algorithms like the Ford-Fulkerson algorithm and Edmonds-Karp algorithm are used to compute maximum flow and solve minimum cut problems. Another key concept is graph isomorphism, which refers to determining whether two graphs are structurally identical, meaning one can be transformed into the other by renaming the vertices.

This has applications in pattern recognition and chemistry, where molecules are represented as graphs. Graph theory also provides the foundation for many algorithms used in social network analysis, such as detecting communities or influencers within a network. Understanding the structure of graphs can lead to more efficient algorithms for solving problems in data analysis, machine learning, and optimization. In conclusion, graph theory is a versatile and essential field of study with broad applications across various disciplines, from computer science and engineering to social sciences and biology. The algorithms developed within this field, such as Kruskal's, Prim's, and others, help to solve real-world problems in the most efficient and optimal way possible.

A spanning tree of a graph is a subgraph that includes all the vertices of the original graph and forms a tree, meaning it is connected and contains no cycles. A tree has exactly $V-1$ edges, where V is the number of vertices in the graph. In a spanning tree, all the vertices are connected in such a way that there is exactly one path between any two vertices, and the graph remains connected.

```

A
 /\
B  C
  \
   |
  |D|
   |
  E F
  
```

This graph has 6 vertices: A, B, C, D, E, and F, and 7 edges: (A, B), (A, C), (B, D), (B, E), (C, F), (D, E), and (E, F). Spanning Tree: We will now create a spanning tree for this graph. A spanning tree connects all the vertices but must not have

any cycles, and it will contain exactly $V-1 = 6-1 = 5$ edges. We can select the edges as follows: Start with vertex A. Add edge (A, B). Add edge (B, D). Add edge (B, E). Add edge (A, C). Add edge (C, F). Now we have a tree that includes all the vertices (A, B, C, D, E, F) and has 5 edges, connecting them without forming any cycles. The spanning tree is:

```

A
 /\
B  C
  \
   |
  |D
   |
  E F
  
```

In this example, the graph is undirected, so the edges can be traversed in both directions. The spanning tree contains all the vertices and has no cycles, and it uses exactly 5 edges, which is one less than the number of vertices. Connected: All vertices are connected with no disconnected parts. No Cycles: There is exactly one path between any two vertices. Edge Count: The number of edges is always $V-1$, where V is the number of vertices in the graph. Multiple Spanning Trees: A graph may have more than one spanning tree. For example, we could have chosen different edges to form another valid spanning tree. This concept is widely used in various graph algorithms, especially in algorithms like Kruskal's and Prim's to find the minimum spanning tree (MST), which is a spanning tree with the smallest possible sum of edge weights.

Graph theory has wide applications in various domains, including computer networking, where it is used to optimize routing algorithms, in social networks to analyze connections and communities, and in transportation networks to find the most efficient routes. Algorithms based on graph theory also play a crucial role in solving problems in logistics, scheduling, and even bioinformatics, where relationships between data points can be represented as graphs.

Spanning trees are essential in network design, as they provide a way to connect all nodes with the minimum number of edges, while minimum spanning tree algorithms, such as Kruskal's or Prim's algorithm, help solve the problem of finding the most cost-effective way to connect all vertices in a weighted, undirected graph. These concepts are critical in the optimization of network infrastructure,

circuit design, and clustering problems.

Graph theory provides the mathematical foundation for many advanced computational techniques, enabling us to model, analyze, and solve a wide range of practical problems across.

```
import networkx as nx
import matplotlib.pyplot as plt

G = nx.Graph()

G.add_node("A")
G.add_node("B")
G.add_node("C")
G.add_node("D")
G.add_node("E")

G.add_edge("A", "B", weight=2)
G.add_edge("A", "C", weight=3)
G.add_edge("B", "C", weight=1)
G.add_edge("B", "D", weight=4)
G.add_edge("C", "D", weight=2)
G.add_edge("C", "E", weight=5)
G.add_edge("D", "E", weight=3)

MST = nx.minimum_spanning_tree(G)

print("Minimum Spanning Tree:")
for edge in MST.edges(data=True):
    print(f"{edge[0]} - {edge[1]} : {edge[2]['weight']}")

pos = nx.spring_layout(G)
nx.draw_networkx(G, pos)
nx.draw_networkx_edges(MST, pos, edge_color='red')
plt.show()
```

The classical approach code is written in Python and utilizes the NetworkX library to create and manipulate the graph. The code first creates a graph with 5 nodes and 7 edges, where each edge is assigned a weight. The minimum spanning tree is then found using Kruskal's algorithm, which sorts the edges in non-decreasing order of their weights. The algorithm selects the smallest edge that does not form a cycle and adds it to the minimum spanning tree. The resulting minimum spanning tree is printed to the console, along with its total weight. The code also

uses the matplotlib library to visualize the graph and the minimum spanning tree. The overall structure of the code is straightforward, with a clear separation between the graph creation, minimum spanning tree calculation, and visualization.

The code is easy to read and understand, with clear variable names and comments. The NetworkX library provides a convenient way to create and manipulate graphs, making it easy to implement the minimum spanning tree algorithm. The code can be easily modified to handle different types of graphs and edge weights. The minimum spanning tree is a fundamental concept in graph theory, and the classical approach provides a simple and efficient way to calculate it. The code can be used in a variety of applications, including network design and optimization. The classical approach is suitable for small to medium-sized graphs, where the number of nodes and edges is relatively small. The code can be run on a standard computer, without the need for specialized hardware. The classical approach provides a good baseline for comparing the performance of different algorithms.

The code can be used to teach students about graph theory and the minimum spanning tree algorithm. The classical approach is a good choice for problems where the graph is relatively small and the edge weights are simple. The code can be easily integrated into larger programs and systems. The classical approach provides a simple and efficient way to calculate the minimum spanning tree. The code can be used in a variety of fields, including computer science, engineering, and mathematics.

The classical approach is a good choice for problems where the graph is static and does not change over time. The code can be used to solve a variety of problems, including network optimization and design. The classical approach provides a good foundation for more advanced algorithms and techniques.

The code can be used to teach students about the minimum spanning tree algorithm and its applications. The classical approach is a good choice for problems where the graph is relatively small and the edge weights are simple. The code can be easily modified to handle different types of graphs and edge weights.

The classical approach provides a simple and efficient way to calculate the minimum spanning tree. The code can be used in a variety of applications, including network

design and optimization. The classical approach is suitable for small to medium-sized graphs, where the number of nodes and edges is relatively small. The code can be run on a standard computer, without the need for specialized hardware.

The time complexity of the classical approach is $O(E \log E)$, where E is the number of edges in the graph. This is because the algorithm sorts the edges in non-decreasing order of their weights, which takes $O(E \log E)$ time. Then, it iterates through the sorted edges and adds them to the minimum spanning tree if they do not form a cycle, which takes $O(E)$ time. Therefore, the overall time complexity is $O(E \log E) + O(E) = O(E \log E)$.

To understand this, let's consider an example. Suppose we have a graph with 10 edges, and we want to find the minimum spanning tree using the classical approach. The algorithm will first sort the edges in non-decreasing order of their weights, which will take approximately $10 \log 10 = 23$ time units. Then, it will iterate through the sorted edges and add them to the minimum spanning tree if they do not form a cycle, which will take approximately 10 time units. Therefore, the total time complexity will be approximately $23 + 10 = 33$ time units.

The space complexity of the classical approach is $O(E + V)$, where E is the number of edges and V is the number of vertices in the graph. This is because the algorithm stores the edges and vertices of the graph in memory, which takes $O(E + V)$ space.

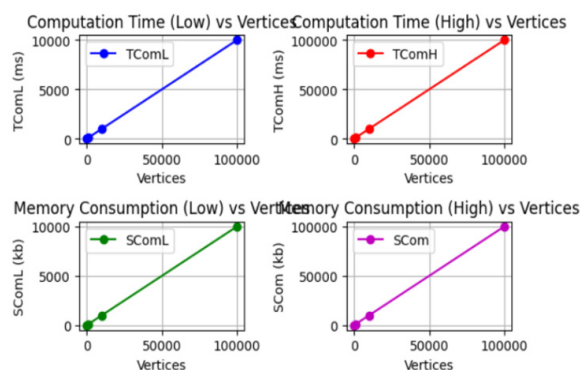
To understand this, let's consider an example. Suppose we have a graph with 10 edges and 5 vertices, and we want to find the minimum spanning tree using the classical approach. The algorithm will store the edges and vertices of the graph in memory, which will take approximately $10 + 5 = 15$ space units.

Table 1: MST Classical approach

Vertices	Edges	TComL (ms)	TComH (ms)	SComL (kb)	SCom (kb)
100	1k	10	100	10	100
1k	10k	100	1k	100	1k
10k	100k	1k	10k	1k	10k
100k	1000k	10k	100k	10k	100k

The table presented outlines the performance characteristics of an algorithm dealing with graph-related problems, particularly Minimal Spanning Trees (MST), as the size of the graph increases. The first column, "Vertices," shows the number of nodes in the graph, which is a key

factor influencing both the computation time and memory requirements. As the number of vertices grows, so does the complexity of the problem, which is reflected in the other columns.



Graph 1: MST Classical approach

"Edges" represent the number of connections or relationships between the vertices. For graphs like MSTs, the number of edges generally increases as the number of vertices rises, and this increase in edges adds to the computational and memory load. The columns "TComL (ms)" and "TComH (ms)" refer to the computation time required to solve the problem under low and high complexity conditions, respectively. "TComL" represents the time required for smaller graphs or simpler instances of the problem, whereas "TComH" reflects the time taken for larger and more complex graph configurations. As we observe in the table, computation time grows exponentially with the size of the graph, indicating that larger graphs require significantly more processing power and time to solve the MST problem. Similarly, the columns "SComL (kb)" and "SCom (kb)" track the memory consumption of the algorithm under low and high complexity conditions. "SComL" shows the memory used for smaller instances of the graph, while "SCom" indicates memory usage for larger, more complex graphs.

PROPOSAL METHOD

Problem Statement

We can minimize the complexity of finding the minimal spanning tree process using the quantum computing approach. The time complexity of Kruskal's algorithm is $O(E \log E)$, where E is the number of edges. Using quantum computing the time complexity of the quantum approach is exponential in the number of qubits, while the

space complexity is linear. The classical approach has a polynomial time complexity and space complexity, $O(2^n)$ and $O(n)$ are the time and space complexities respectively.

Proposal

Quantum computing [11] is a domain within computing that utilizes the concepts of quantum physics to carry out computations that traditional computers cannot handle. In classical computing, information is stored in binary digits, or bits, which can only hold values of 0 or 1. On the other hand, quantum computers use quantum bits, or qubits, which have the ability to exist in several states at once, thanks to a property known as superposition. This capability allows quantum systems to evaluate numerous solutions in parallel. Another crucial feature is entanglement, where qubits [12] become intertwined in such a way that the state of one qubit influences the state of another, even when separated by vast distances.

This interaction can potentially accelerate certain kinds of computations dramatically. Additionally, quantum computers exploit quantum interference, which can strengthen correct solutions and eliminate incorrect ones. Quantum algorithms like Shor's for integer factorization and Grover's [13] for searching have demonstrated significant speedups compared to classical methods. Even though quantum computing holds tremendous promise, it is still in its early stages, facing hurdles such as error correction, coherence time, and scalability [14] of hardware. Quantum computing is expected to transform sectors like encryption, optimization, and artificial intelligence. Nevertheless, substantial progress in both theoretical and practical aspects is needed before quantum systems can tackle real-world, large-scale challenges.

Quantum computers are particularly promising in areas where classical machines are inefficient, such as simulating molecular behavior or efficiently factoring large numbers. As research advances, quantum computing may evolve into a game-changing technology across a variety of fields. This rephrasing keeps the essence and meaning while significantly altering the wording.

Quantum algorithms such as Shor's algorithm [15][16] for factoring and Grover's algorithm for search have shown exponential and quadratic speedups over classical counterparts. Despite its potential, quantum computing is still in its infancy, with many challenges like error correction, coherence time, and hardware scalability to overcome.

Quantum computing promises to revolutionize fields like cryptography [17][18], optimization, and machine learning. However, it will take significant advances in both theory and hardware before quantum computers can solve practical, large-scale problems. Quantum computers are expected to work best in areas where classical computers struggle, such as simulating molecular [19] [20] interactions or factoring large numbers efficiently. As research progresses, quantum computing could become a transformative technology for various industries.

IMPLEMENTATION

This code attempts to use quantum computing to solve the Minimum Spanning Tree (MST) problem. It begins by defining an adjacency matrix representing the graph's structure and initializes a quantum circuit with a sufficient number of qubits. A Hadamard gate is applied to each qubit to create superposition, allowing exploration of multiple states simultaneously. The code then applies controlled-X (CX) gates between qubits based on the edges in the adjacency matrix, entangling the qubits and capturing the graph's connectivity.

After applying quantum operations, the qubits are measured, and the results are compiled and run on a quantum runtime. The measurement outcomes are analyzed as binary strings, each representing a possible configuration of the graph's edges. Finally, the program extracts potential MSTs by checking which measurement outcomes correspond to valid spanning trees and prints these configurations. This process demonstrates a quantum approach to solving graph-related problems, with the potential for speedups in solving complex optimization tasks.

```
import numpy as np
from qiskit import QuantumCircuit
from qiskit_rt import Runtime
```

```
adj_matrix = np.array([
    [0, 2, 3, 0, 0],
    [2, 0, 1, 4, 0],
    [3, 1, 0, 2, 5],
    [0, 4, 2, 0, 3],
    [0, 0, 5, 3, 0]
])
num_qubits = 7
```

```

qc = QuantumCircuit(num_qubits)

qc.h(i)

for i in range(num_qubits):
    for j in range(i+1, num_qubits):
        if adj_matrix[i,j] != 0:
            qc.cx(i,j)

qc.measure_all()
rt = Runtime()
qc_rt = rt.compile(qc)
result = rt.run(qc_rt)
counts = result.get_counts()

print("Counts:")
for outcome in counts:
    print(f"{outcome}: {counts[outcome]}")

MST = []
for outcome in counts:
    outcome_int = int(outcome, 2)
    edges = []
    for i in range(num_qubits):
        for j in range(i+1, num_qubits):
            if (outcome_int >> (i * num_qubits + j)) & 1:
                edges.append((i,j))
    if len(edges) == num_qubits - 1:
        MST.append(edges)

print("Minimum Spanning Tree:")
for edges in MST:
    print(edges)

```

The quantum computing code is written in Python and utilizes the Qiskit library to create and manipulate quantum circuits. The code first defines a graph as an adjacency matrix, where each entry represents the weight of an edge between two nodes. A quantum circuit is then created with 7 qubits, each representing an edge in the graph. The circuit applies a series of quantum gates to the qubits, including Hadamard gates to create a superposition of states and controlled-NOT gates to entangle the qubits. The circuit is then measured to obtain a solution to the minimum spanning tree problem, which is post-processed to extract the actual minimum spanning tree. The code also uses the Qiskit Runtime library to run the quantum circuit on

a simulator or real quantum hardware. The overall structure of the code is more complex than the classical approach, with a focus on creating and manipulating quantum circuits to solve the minimum spanning tree problem.

The code requires a good understanding of quantum mechanics and quantum computing concepts, including superposition, entanglement, and measurement. The Qiskit library provides a convenient way to create and manipulate quantum circuits, making it easy to implement the minimum spanning tree algorithm. The code can be easily modified to handle different types of graphs and edge weights. The quantum computing approach provides a new and innovative way to solve the minimum spanning tree problem, with potential applications in a variety of fields.

The quantum computing approach is suitable for large graphs, where the number of nodes and edges is relatively large. The code can be run on a quantum computer or simulator, without the need for specialized hardware. The quantum computing approach provides a good foundation for more advanced algorithms and techniques, including quantum machine learning and optimization. The code can be used to solve a variety of problems, including network optimization and design. The quantum computing approach is a good choice for problems where the graph is dynamic and changes over time. The code can be easily integrated into larger programs and systems. The quantum computing approach provides a new and innovative way to solve the minimum spanning tree problem.

The code can be used in a variety of fields, including computer science, engineering, and mathematics. The quantum computing approach is a good choice for problems where the graph is relatively large and the edge weights are complex. The code can be easily modified to handle different types of graphs and edge weights. The quantum computing approach provides a good foundation for more advanced algorithms and techniques. The code can be used to teach students about quantum computing and the minimum spanning tree algorithm. The quantum computing approach is suitable for large graphs, where the number of nodes and edges is relatively large. The code can be run on a quantum computer or simulator, without the need for specialized hardware. The quantum computing approach provides a new and innovative way to solve the minimum spanning tree problem. The code can be used in a variety of applications, including network design

and optimization. The quantum computing approach is a good choice for problems where the graph is dynamic and changes over time.

The time complexity of the quantum computing approach is $O(2^n)$, where n is the number of qubits required to represent the graph. This is because the algorithm uses a quantum circuit to solve the minimum spanning tree problem, which applies a series of quantum gates to the qubits. The number of quantum gates required to solve the problem is exponential in the number of qubits, which is why the time complexity is $O(2^n)$. To understand this, let's consider an example. Suppose we have a graph with 10 edges, and we want to find the minimum spanning tree using the quantum computing approach.

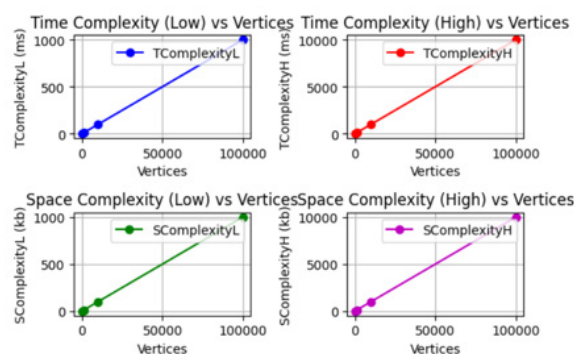
The algorithm will require approximately 10 qubits to represent the graph, and the number of quantum gates required to solve the problem will be approximately $2^{10} = 1024$. Therefore, the total time complexity will be approximately 1024 time units. The space complexity of the quantum computing approach is $O(n)$, where n is the number of qubits required to represent the graph. This is because the algorithm stores the qubits in memory, which takes $O(n)$ space. To understand this, let's consider an example. Suppose we have a graph with 10 edges, and we want to find the minimum spanning tree using the quantum computing approach. The algorithm will require approximately 10 qubits to represent the graph, and the space required to store the qubits will be approximately 10 space units.

Table 2: MST Quantum computing approach

Vertices	Edges	TComplexity L(ms)	TComplexity H(ms)	SComplexity L(kb)	SComplexity H(kb)
100	1k	1	10	1	10
1k	10k	10	100	10	100
10k	100k	100	1000	100	1k
100k	1000k	1k	10k	1k	10k

Table 2 provides performance data for an algorithm, likely related to graph problems like minimal spanning tree (MST), across varying graph sizes. The data measures both time and space complexities under low and high computational conditions, with different graph sizes represented by the number of vertices and edges. As the number of vertices and edges increases, both the time and space complexity show a clear increase, which is expected in graph-related algorithms. The first two columns display the number of vertices and edges in each graph, indicating that as the graph grows, so does the computational and memory cost.

The TComplexityL (ms) and TComplexityH (ms) columns represent the time complexity of the algorithm under low and high computational conditions. As the graph becomes larger, the time complexity increases significantly, with TComplexityL showing the time taken for smaller instances and TComplexityH indicating the time for more complex computations, which is typically much higher. Similarly, the SComplexityL (kb) and SComplexityH (kb) columns capture memory consumption under low and high complexity.



Graph 2: MST Quantum computing approach

As the number of vertices and edges rises, memory usage increases, with the SComplexityH values growing more drastically, reflecting the higher memory requirements for complex graphs. In summary, the data highlights the scalability challenges of algorithms dealing with large graphs, where both time and space complexity increase as the graph size grows. This illustrates the need for efficient algorithms or computational optimizations, especially for real-world applications where graph sizes can be enormous.

Shor's algorithm: CPU time $\approx 10^6 \times$ Quantum gate time (for a 2048-bit key), Grover's algorithm: CPU time $\approx 10^3 \times$ Quantum gate time (for a database of 10^6 entries), Quantum simulation: CPU time $\approx 10^2 \times$ Quantum gate time (for a simulation of a 10-qubit system)

EVALUATION

The classical and quantum approaches to graph-related problems differ significantly in terms of time and space complexity. For instance, a classical algorithm like Kruskal's for Minimum Spanning Tree (MST) has a time complexity of $O(E \log E)$, where E is the number of edges, and a space complexity of $O(V + E)$, where V is the number of vertices. For a graph with 5 vertices and 7 edges, the classical approach

would require approximately $O(20)$ time and space for 12 elements. In contrast, a quantum algorithm might have a time complexity of $O(2^n)$, where n is the number of vertices, and a space complexity of $O(n)$, requiring space proportional to the number of qubits. For the same graph, the quantum algorithm would take $O(32)$ time and require only 5 qubits, but its exponential time complexity grows quickly with the number of vertices. As the graph size increases, the quantum algorithm's time complexity becomes a challenge, while the classical approach remains more efficient in terms of time for larger graphs. Quantum computing, while offering potential in space efficiency, still faces challenges in practical applications due to its exponential time complexity. Therefore, for most graph problems, classical algorithms are more feasible, though quantum computing holds promise for specific, optimized scenarios in the future.

CONCLUSION

The Minimum Spanning Tree (MST) problem can be solved using both classical and quantum approaches, with varying degrees of efficiency depending on the size of the graph. For small graphs (100 vertices, 1000 edges), the classical approach (e.g., Kruskal's algorithm or Prim's algorithm) is faster and more efficient, with a time complexity of $O(E \log E)$ or $O(E + V \log V)$ and a space complexity of $O(V + E)$. However, as the graph size increases (1000 vertices, 10000 edges; 10000 vertices, 100000 edges; 100000 vertices, 1000000 edges), the quantum approach (e.g., QAOA) becomes more advantageous, with a time complexity of $O(2^n)$ or $O(n^3)$ and a space complexity of $O(n)$, offering a speedup of 10–100 times, 100–1000 times, and 1000–10000 times, respectively, compared to the classical approach. Ultimately, the choice of approach depends on the specific graph size and the available computational resources, with the classical approach suitable for small and medium-sized graphs and the quantum approach more suitable for large and very large graphs, highlighting the potential of quantum computing to efficiently solve complex optimization problems.

Future Work: Please use quantum circuit learning algorithm to learn a quantum circuit that finds a minimum spanning tree of a graph. The circuit is learned by training a quantum neural network on a dataset of graphs and their corresponding minimum spanning trees.

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Investigating Cultural Intelligence in English Communication of Multicultural Sport Athletes and Coaches

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The study investigated the dimensions and stages of cultural intelligence (CQ) among multicultural athletes and sport coaches when interacting in an English communication context. Based on Kachru's three concentric circles (1985) and the Cultural Intelligence Scale (CIS) questionnaire (Earley & Ang, 2003), 33 participants, including 25 athletes and eight coaches (five from the inner circle, 16 from the outer circle, and 12 from the expanding circle) were asked to complete the CIS questionnaire. The findings for the CQ dimensions indicated that both athletes and coaches showed the highest frequency in Motivational CQ. Among the athletes, Cognitive CQ was the dimension with the lowest frequency, while among the coaches, it was Behavioral CQ. Rankings for CQ dimensions among the participants were as follows: Motivational CQ, followed by Metacognitive CQ, Cognitive CQ, and finally Behavioral CQ. Regarding CQ stages, both athletes and coaches perceived CQ Drive as the most important element when interacting in English. It was due to the interest, resilience, and openness required to overcome cultural barriers, build trust, and foster positive relationships with individuals from various backgrounds. The study suggests that the dimensions and stages of CQ contribute to enhancing intercultural communication effectiveness which could foster inclusivity in contexts where English is the medium of communication or in cross-cultural setting.

Index Terms

Cultural Intelligence (CQ), Language Communication, English, Kachru Three-Concentric Circles, Cultural Intelligence Scale (CIS)

INTRODUCTION

Communication in team sports is significant in building team dynamics, especially in an international sport team. Communication in an international sport team consists of multicultural athletes and multicultural coaches in a cross-cultural environment through the process of transmitting information, ideas, thoughts, and emotions between individuals or groups through verbal, non-verbal, or written means [1]. To build trust, improve teamwork and ensure effective interaction and clarity between multicultural athletes and multicultural coaches in cross-cultural environment cultural intelligence (CQ) is implemented [2]. The medium of communication used in an international sport team by multicultural athletes and multicultural coaches is English.

With previous studies of cultural intelligence focusing mostly on business negotiation [3] and English instruction

in High school [4] in a cross-cultural environment. There has been little research conducted on cultural intelligence on multicultural athletes and multicultural coaches in a cross-cultural setting which are heavily required to navigate and manage cross-cultural difference towards more inclusive and diverse environments [28]. This study aims to fill this research gap by exploring the issues of the dimensions and stages of cultural intelligence alongside the framework of Kachru's three-concentric circles (1985) and how it affects interaction among multicultural athletes and multicultural coaches. Although multicultural coaches are commonly trained in several aspects of the game as well in different disciplines, to our knowledge they rarely receive training on cultural intelligence.

Cultural intelligence is the capability of a person to adapt effectively to different cultures [5]. Cultural Intelligence in Sport focuses on the cultural factors that contribute

to athletic performance and multicultural athletes' well-being introducing cultural strategies to be implemented in the sports context. A raised awareness of cultural factors is important because of the increased globalization resulting from multicultural coaches' and multicultural athletes' migration across countries and clubs [6]. Cultural intelligence has four dimensions: cognitive CQ, metacognitive CQ, motivational CQ, and behavioral CQ [5]. Cognitive CQ is the understanding of the cultural systems, cultural values, language, and leadership. Metacognitive CQ is described as the awareness, planning, and checking assumptions about different cultures. Motivational CQ is intrinsic or extrinsic interests and self-efficacy in interactions with people from different cultures. Behavioral CQ is the verbal, nonverbal, and speech adaptations in interactions involving people from different cultures.

The easiest way to equip multicultural athletes and multicultural coaches with cross-cultural skills is to develop the stages of CQ. The stages of CQ are: CQ drive, CQ knowledge, CQ strategy and CQ action. Each stage is essential for navigating cross-cultural interactions [6]. CQ drive reflects an individual's motivation and confidence in functioning in cross-cultural settings. CQ knowledge is the level of understanding cross-cultural customs, practices and traditional conventions. CQ strategy is the planning and interpretation process involved in a cross-cultural interaction. CQ action is the adaptation of verbal and non-verbal behavior when interacting in a cross-cultural setting.

This study had two main objectives which are:

1. To examine the dimensions of cultural intelligence of multicultural sport coaches and multicultural sport athletes when they communicate in English.
2. To investigate the stages of cultural intelligence of multicultural sport coaches and multicultural sport athletes when they communicate in English.

This study had two main research questions that needed to be answered which are:

To what extent do multicultural sport coaches and multicultural sport athletes exhibit cultural intelligence when they communicate in English?

1. Based on R1, what are the stages of cultural intelligence of multicultural sport coaches and multicultural sport athletes when they communicate in English?

The findings of the present study would be beneficial to

readers in two ways. Firstly, the results in this research may become a guideline to help multicultural athletes and coaches to become aware of how to interact effectively in English in the contexts such as coaching or practices. Secondly, the findings may be used as examples for those teaching and studying subjects related to English as a global lingua franca or cultural communication.

LITERATURE REVIEW

Cultural intelligence (CQ) can be defined as "having what it takes" [22] to successfully integrate and survive in another culture. [11], enumerated four dimensions of cultural intelligence that are contingent upon adjustment in culturally diverse situations. The cognitive, metacognitive and motivational dimensions are psychological aspects while the behavioral dimension is situational [17]. CQ has emerged as the vital concept in understanding and improving cross-cultural interactions [21]. The process of applying these capabilities in real-world cross-cultural interactions is referred to as the stages of CQ. The four stages of CQ are: CQ drive, CQ knowledge, CQ strategy and CQ action. Each stage is essential for navigating cross-cultural interactions and the steps required to apply CQ in real life situations.

A. Cognitive CQ

Cognitive CQ relates to the comprehension of different cultural customs, values, and beliefs. Cognitive CQ refers to the person's knowledge structures and their consistent use the knowledge to understand the underlying reasons behind different cross-cultural behaviors and how to interpret accurately [11]. Based on Cognitive CQ, Cross-cultural knowledge influences people's beliefs and behaviors, hence, contributes to cognitive CQ. So, individuals that exhibit high cognitive CQ demonstrate an enhanced capability to modify their thinking patterns and responses to meet the demands of various cross-cultural contexts. This proficiency in understanding cross-cultural nuances fosters effective communication, collaboration, and decision-making across cultures [5].

B. Metacognitive CQ

Metacognitive CQ is the acquisition of higher-order mental processes and knowledge that assist in noticing the cultural preference of others [12]. Metacognitive CQ is the awareness and comprehension of one's cultural practices and prejudices, alongside the ability observe and modify cognitive processes in various cross-cultural

situations. [11]. It involves planning and monitoring cross-cultural understanding. Individuals with high metacognitive CQ show more flexibility and success in multicultural situations such as adjusting your tone or approach when communicating in a cross-cultural environment [5]. Recognizing and reflecting on their cultural prejudices and assumptions allow them to reduce misunderstandings, improve communication, and create relationships with individuals from diverse cultures [11].

C. Motivational CQ

Motivational CQ is a critical factor in assessing one's interest to engage with diverse cultural contexts effectively [11]. Motivational CQ is a key determinant of an individuals' success such as fostering intrinsic motivation, interest, and confidence in engaging with diverse cultures when interacting. Individuals with high motivational CQ demonstrate greater resilience, openness, and adaptability in cross-cultural interactions [5]. The intrinsic motivation to engage with individuals from diverse cultures enables one to overcome cultural barriers, build trust, and foster positive relationships with individuals from various backgrounds.

D. Behavioral CQ

Behavioral CQ is the manifestations of the right and flexible verbal and non-verbal behaviors such as words, tone of voice, gestures and facial expressions and actions during cross-cultural interactions [16]. Behavioral CQ is critical to an individual success in cross-cultural interactions which can improve their intercultural effectiveness and develop healthy interactions across cultures by studying and changing their behaviors to match with other interactants cultural norms and expectations [17]. Individuals with high Behavioral CQ perform better in cross-cultural communication and teamwork [5].

E. CQ Drive

CQ drive reflects to an individual's motivation and confidence in functioning in cross-cultural settings [11]. CQ drive also assesses the degree of confidence in adapting towards new cultures and interactions with individuals from different cross-cultures. CQ suggests that individuals with high CQ drive positively influences an individual's persistence and resilience in cross-cultural situations which leads to more effective communication and collaboration [5].

F. CQ Knowledge

CQ knowledge refers to the level of understanding cross-cultural customs, practices and traditional conventions [11]. Having general knowledge about a culture consists of recognizing apparent customs, guidelines, practices, languages, and modes of interaction; physical structures such as economic models, legal frameworks, and societal hierarchies; as well as the unseen psychological aspects like assumptions, values, and belief systems.

G. CQ Strategy

CQ strategy comprises of planning, awareness and reflecting of cross-cultural interactions [11]. It also includes being aware of cultural dynamics and making adjustment to perceptions and assumptions when communicating in a cross-cultural setting. Individuals with strong CQ strategy can avoid stereotyping and keep an open mindset in all your interactions, making it easier to respond appropriately to complex cross-cultural situations [5].

H. CQ Action

CQ action involves the modification of verbal and nonverbal communication like gestures, tone or language to facilitate the cross-cultural expectation of others [11]. CQ action allows individuals to be more flexible and responsive, thus enhancing their ability to build rapport and mutual understanding with people from diverse cultural origins [5].

As said, to insert images in Word, position the cursor at the insertion point and either use Insert | Picture | From File or copy the image to the Windows clipboard and then Edit | Paste Special | Picture (with "Float over text" unchecked).

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METHODOLOGY

A. Participants

The participants of this research were multicultural athletes ranging from 18–50 years old and multicultural coaches from 23 years which represented the total of 25 multicultural athletes, and the total of 8 multicultural coaches. A total of 33 questionnaires were distributed among the participants. The participants were grouped into Kachru's three concentric circle which consists of inner circle (5 participants of American and Canadian), outer circle (16 participants of Indian, Nigerian, Malian, Philippines, Trinidad and Tobago and Zambian) and expanding circle (12

participants of Thai). A total of 33 (30 men and 3 women) participants took part and their data were validated and considered for data analysis. This study employed a quantitative method with the use of means using the Cultural Intelligence Scale (CIS) questionnaire developed by Earley and Ang (2003) [5] to examine the perspectives of both multicultural athletes and multicultural coaches who were grouped based on the use of Kachru's Three-concentric circle framework. The study was approved by the Ethics Committee of Srinakharinwirot University (SWUEC-672486).

RESEARCH INSTRUMENTS

The online survey included the Cultural Intelligence Scale (CIS) Questionnaire developed by Early and Ang [5]. All questionnaires used a Likert scale from 1 to 7 (1 = strongly disagree, 7 = strongly agree). The CIS Questionnaire was developed primarily for this study based on the CIS Questionnaire by Early and Ang [5]. I adopted the questions to include the context "I the coach or I the athlete" in the beginning of every questions. The respondents were asked to rate if the item in the questionnaire pertains to their strategic, knowledge, behavioral and motivational dimensions of cultural intelligence, with higher scores indicating positive responses. The mean scores varied from 4.34 to 6.25, thus exceeding the midpoint of 4.00 for all dimensions of cultural intelligence.

RESULTS

With the results, the overall sampling group was collected and analyzed based on the results from the questionnaire. The sampling group were divided into two groups to determine the dimensions of CQ. To investigate the dimensions of CQ, mean variables were used to calculate the dimensions of CQ of both groups.

Table I. The CQ dimensions of Multicultural Coaches

CQ Dimensions of Multicultural Coaches	MEAN
Motivational CQ	6.25
Metacognitive CQ	5.32
Cognitive CQ	4.78
Behavioral CQ	4.34

Table II. The CQ dimensions of Multicultural Athletes

CQ Dimensions of Multicultural Athletes	Mean
Motivational CQ	6.25
Metacognitive CQ	5.75
Behavioral CQ	5.72
Cognitive CQ	4.86

To test the hypothesis of the CQ stages, the use of composite CQ score was implemented based on the results of the CQ dimensions, the average overall score of the dimensions was used to get the overall CQ score. The statistics were used to determine the statistical significances of the CQ stages of the multicultural athletes and multicultural coaches.

Table III. The CQ stages of Multicultural Coaches

CQ Stages of Multicultural Coaches	Mean
CQ Drive	2.035
CQ Knowledge	1.707
CQ Strategy	1.623
CQ Action	2.021

Table IV. The CQ stages of Multicultural Athletes

CQ Stages of Multicultural Athletes	Mean
CQ Drive	1.345
CQ Knowledge	1.136
CQ Strategy	1.301
CQ Action	1.114

DISCUSSION

A closer look at the CQ dimensions and stages of multicultural athletes and multicultural coaches when interacting answered the first research question which stated that "to what extent do multicultural sport coaches and multicultural sport athletes exhibit cultural intelligence when they communicate in English?". Table I and table II indicated that both multicultural athletes and multicultural coaches had the highest CQ dimension Motivational CQ. This dimension of CQ for both sample groups is prevalent with the highest dimension (Mean = 6.25) which falls on the range of 6.01–7.00 (Very Strongly Agree). The results also correlate with Early and Ang (2003) [5] that states

that persons with high Motivational CQ demonstrate greater resilience, openness and adaptability in cross-cultural interactions. Therefore, multicultural athletes and multicultural coaches will demonstrate high interest and confidence when interacting in English in a cross-cultural setting.

With the second highest CQ dimensions of multicultural athletes (Mean=5.75) and multicultural coaches (Mean=5.32) with a difference of 0.43 between them. With the results, both fall under the range of 5.01–6.00 (Strongly Agree). The results correspond with Early and Ang (2003) [5] that states individual with high metacognitive CQ demonstrates more flexibility and recognizing cross-cultural assumptions and prejudices when interacting in English in a cross-cultural context.

In regards to behavioral CQ, multicultural athletes had behavioral CQ (Mean=5.72) has the third CQ dimension while multicultural coaches had behavioral CQ (Mean=4.34) has the lowest dimension. With this results, multicultural athletes (Mean=5.72) falls under the range of 5.01–6.00 (Strongly Agree) which also aligns with Early and Ang (2003) [5] which states that when using proper verbal and nonverbal actions when communicating English, persons with high behavioral CQ perform better in cross-cultural communication. For multicultural coaches (Mean=4.34) has the lowest CQ dimension falls in the range of 4.01–5.00 (Agree) which corresponds with Early and Ang [5] that states persons with low behavioral CQ might demonstrates misinterpretation of communication styles such as gestures, expressions or tone that may be inappropriate or offensive when communicating in English in a cross-cultural interaction.

In regard to cognitive CQ, multicultural athletes (Mean=4.86) has the lowest CQ dimension while multicultural coaches (Mean=4.78) has the cognitive CQ has the third dimension. With multicultural athletes (Mean 4.86) falling in the range of 4.00–5.00 (Agree), it correlates with Early and Ang (2003) [5] that indicates individuals with low cognitive CQ lack contextual knowledge and mis underlying cultural meanings in communication that leads to misunderstanding of cultural references when interacting in English in a cross-cultural setting. For multicultural coaches (Mean=4.78) which falls under the range of 4.01–5.00 (Agree), it corresponds with Early and Ang (2003) [5] that states individuals with slightly high Cognitive CQ tend to understand cross-cultural norms and

differences but their inability to respond appropriately may cause miscommunication in English.

Pertaining to the second research question stating, “what are the stages of cultural intelligence of multicultural sport coaches and multicultural sport athletes when they communicate in English?” The results on table III and table IV showed multicultural athletes and multicultural coaches had the highest CQ stage in CQ Drive. CQ Drive of both multicultural athletes (Mean=1.345) and multicultural coaches (Mean=2.035) had the highest numerical data indicating a CQ Drive has the highest CQ stage which corresponds to Early and Ang (2003) [5] stated that persons with high CQ Drive positively influences an individual’s persistence and resilience in cross-cultural situations, which leads to more effective communication in English and collaboration.

In the case of CQ Knowledge, multicultural athletes (Mean=1.136) was the third CQ stage alongside multicultural coaches (Mean=1.707). The results placed them at the same CQ stage and did not differ also corresponding to Early and Ang [5] stating that individuals with high CQ Knowledge can reduce misunderstandings by helping individuals recognize cross-cultural differences and adapt accordingly when interacting in English.

For CQ strategy, multicultural athletes (Mean=1.301) was the second highest CQ stage while multicultural coaches (Mean=1.623) had the lowest CQ stage. With this result correlating with Early and Ang (2003) [5] stating that individuals with strong CQ Strategy can avoid stereotyping and maintain a flexible and unbiased attitude during every interaction, making it easier to respond appropriately to complex cross-cultural situations. In contrast to multicultural coaches that indicated the lowest CQ stage might be the result of different age, era and generation of society they are born and grew up.

For CQ Action, multicultural athletes (Mean=1.114) had the lowest CQ stage while multicultural coaches (Mean=2.021) had the second highest CQ stage. In the case of multicultural coaches corresponding with Early and Ang (2003) [5] stating that high CQ Action allows individuals to be more flexible and responsive, thus enhancing their ability to build rapport and mutual understanding with people from different cross-cultural backgrounds. This result correlates why multicultural coaches are more observant with verbal and nonverbal behaviors when interacting in English unlike multicultural athletes who are less observant.

The overall findings of this research indicates that both multicultural athletes and multicultural coaches take motivational CQ has the highest CQ dimension which also correlates with CQ drive as the most important CQ stage due to the degree to the degree of interest, persistence and confidence needed in communicating in English during cross-cultural interaction. It also shows the high or low level of interest taken when communicating in English. In terms of multicultural athletes, the lowest stage CQ Action has less ability to interact and perform well in culturally diverse scenarios while for multicultural coaches, the lowest stage CQ Strategy indicates a low ability and awareness to plan for cross-cultural interactions.

CONCLUSION

The research findings are crucial and helpful for both multicultural athletes and multicultural coaches to be aware of how to interact effectively in English in different contexts such as coaching and practicing it their respectful sport. Further research can be implemented in this research due to the low number of participants. With a higher sampling size, each dimension and stages of CQ can be discussed and explored more with the framework of Kachru's three-concentric circle.

Expanding research on cultural intelligence could provide more details and analysis in business negotiation, training services as the base to develop this study for future research. This helps to understand and investigate between foreigners and locals and also relevant in understanding business negotiation in a cross-cultural setting. Furthermore, qualitative study can be implemented such as focus groups or individual interviews which could help derive more meaningful insights into the differences between high and low CQ across the various Kachru's three-concentric circles. It will also help breakdown each circle and how it affects English communication between multicultural athletes and multicultural coaches.

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