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BOOK *of* ABSTRACTS

Transformative Education and Lifelong Learning for Sustainable Growth

5TH ANNUAL INTERNATIONAL TELLS CONFERENCE

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Norad

UiA University of Agder

University of Rwanda

Makerere University

Jimma University

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Welcome Notes

Message from the Principal, University of Rwanda – College of Education

Prof. Florien Nsanganwimana

Distinguished Guests, Keynote Speakers, Session Chairs, Esteemed Researchers, and Conference Delegates,

It is my distinct honor and pleasure to welcome you all to the TELLS International Conference 2026 at the University of Rwanda – College of Education.

This conference brings together leading scholars, educators, and policy experts from various corners of the world to explore transformative pedagogies, artificial intelligence, and digital innovations in education. As host institution, UR-CE remains committed to advancing evidence-based teaching practices, teacher professional development, and inclusive learning technologies.

Over the next two days, our collective goal is to share research insights, foster academic networks, and chart actionable pathways for future-oriented education. I encourage every delegate to engage actively in the plenary discussions, parallel thematic sessions, and poster presentations.

On behalf of the Management and academic community of the University of Rwanda, I wish you fruitful deliberations and a memorable stay in Kigali.

Prof. Florien Nsanganwimana
Principal, University of Rwanda – College of Education

Message from the TELLS Project Manager

Dr. Mathias Nduwingoma

Respected Officials, Delegates, Steering Board Members, Partners, Colleagues and Conference Participants,

On behalf of the TELLS Project team, I extend a warm welcome to each of you attending the TELLS 2026 Final Conference.

The TELLS initiative was established to strengthen institutional research capacity, promote digital pedagogy, and leverage emerging educational technologies across higher education and school systems. This conference serves as a major milestone, providing a platform to share research deliverables, evaluate project outcomes, and discuss the long-term sustainability of digital transformation in education across the region.

With over 60 oral presentations and 20 poster displays scheduled across our streamlined parallel tracks, the programme highlights the breadth and quality of academic work generated through this collaboration.

I express my sincere appreciation to our international and local partner institutions, session chairs, secretariats, and the steering committee for their dedication to making this event a success. May this gathering spark vibrant academic discussions and lasting research partnerships.

Welcome to the conference!

Dr. Mathias Nduwingoma
TELLS Project Manager, Rwanda

Keynote Speakers

Dr. Jessica Norah Aguti

Dr. Jessica Norah Aguti is a Professor of Open, Distance & eLearning at the Faculty of Science & Education, Busitema University. She was formerly a Director of the Institute of Open, Distance & e-Learning, Makerere University, and worked at the Commonwealth of Learning (COL), Vancouver, as an Education Specialist, Teacher Education, for three years. Prof. Aguti joined academia in 1990 as a lecturer in the nascent Distance Education Unit. Over the years, she has actively participated in the growth and development of open, distance and e-learning (ODeL) in universities in Uganda and the wider region. She has vast experience in designing programmes, training academics in developing learning materials, and providing learner support. Prof. Aguti has also been involved in various research studies and in the evaluation of different programmes, and is a strong believer in the democratization of education and the role of ODeL in achieving that democratization.

Dr. Tobias Scholz

Dr. Tobias Scholz, Associate Professor at the University of Agder, is a pioneer in esports research with 25 years of experience. Specializing in academic esports and human resource management, he authored “eSports is Business” and co-edited the “Routledge Handbook of Esports.” As founder of the Esports Research Network and Chief Scientific Officer of Metagame, Dr. Scholz bridges academia and industry. His work in Norway focuses on developing innovative degree programmes that use esports to teach future-workforce skills. A member of the first generation of esports researchers — also known as the “godfather of esports research” — Dr. Scholz continues to shape the field’s evolution, combining academic rigor with practical industry insight.

Acknowledgements

Conference Organizing Committee

- Dr. Mathias Nduwingoma (Chairperson)
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Theme I. Digital Education, AI and Learning Technologies

Oral Presentations

1. Digital Game-Based Learning in African Higher Education: Opportunities, Challenges and Future Directions

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Abstract

African higher education institutions are increasingly exploring innovative pedagogies to enhance student engagement, improve learning outcomes, and prepare graduates for a rapidly evolving digital world, and digital game-based learning (DGBL) has emerged as a promising strategy combining experiential learning, authentic problem-solving, and learner-centred approaches (Prensky, 2001; Gee, 2003). This conceptual paper critically examines the potential of DGBL to advance educational transformation within African higher education, aiming to identify the opportunities it offers, analyse the challenges constraining its adoption in African and resource-constrained settings, and propose future directions for its contextually responsive integration across diverse disciplines. It synthesises literature on DGBL, educational innovation, and higher education transformation with reflective insights from South African health sciences education. Peer-reviewed articles, books, and reviews published in English on game-based and serious-game learning were sourced through Scopus, Web of Science, ERIC, and Google Scholar, prioritising work situated in or transferable to African contexts, and analysed thematically. Four themes emerged: DGBL promotes active, experiential learning through authentic and engaging experiences; it supports transferable skills including collaboration, communication, digital literacy, and problem-solving; its implementation is often constrained by technological infrastructure, resource limitations, educator preparedness, and institutional resistance; and it offers opportunities for curriculum contextualisation through locally relevant, culturally responsive experiences. These findings align with evidence of game-based learning's positive impact on motivation and effectiveness (Papastergiou, 2009) and recent reviews of its growing role in digital transformation (Brandl & Schrader, 2024). DGBL thus offers significant potential for advancing educational transformation in African higher education, though sustainable implementation requires investment in educator development, institutional support, digital infrastructure, and locally relevant scholarship. Future research should develop contextually responsive approaches that support effective DGBL integration across diverse disciplines and settings.

Keywords: *Digital game-based learning; higher education; Africa; educational innovation; digital transformation*

2. Applied Teacher-Supported Blended Learning mode to improve Senior Four students' Higher-Order Thinking Skills in Optics. A case study of Nyarugenge District, Rwanda

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Abstract

The digital technologies integration, when effectively mediated by teachers, has become a key strategy for promoting transformative education in secondary schools and developing students' higher-order thinking skills (HOTS). However, effective technology integration requires purposeful teacher support to ensure meaningful learning experiences. This study, investigated the effects of teacher-supported blended learning (TSBL) to drive digital education and to develop Senior Four students 'higher-order thinking skills in optics for selected schools in Nyarugenge District, Rwanda. The intervention combined face-to-face classroom instruction with **Google Classroom, Google Meet**, teacher guidance and **PhET interactive simulations/laboratory activities,** while teachers provided continuous guidance and feedback throughout the learning process. A mixed-methods quasi-experimental design involving 117 students compared teacher-supported blended learning with conventional face-to-face instruction. Quantitative data were collected using the Optics Higher-Order Thinking Skills Test, while questionnaires, interviews, and classroom observations generated qualitative evidence. The base-line results indicated no statistically significant difference in Higher-Order Thinking Skills between the experimental and control groups before the intervention. After intervention, results revealed significantly higher HOTS among students receiving blended learning ($M = 80.42$, $SD = 5.87$) than those receiving conventional instruction ($M = 50.47$, $SD = 8.07$), $p < .001$, with a very large effect size (Cohen's $d = 3.30$). Qualitative findings indicated improved analytical reasoning, collaboration, engagement, and confidence. To conclude, the teacher-supported blended learning effectively promotes higher-order thinking skills and supports its integration into Rwanda's CBC to strengthen schools to use digital innovation. The findings offer practical implications for policymakers, curriculum developers, and school leaders seeking to strengthen CBC implementation through technology-supported instruction.

Keywords: *digital learning, higher-order-thinking, optics, supported blended learning.*

3. The Role of Mobile Technology, Simulations, and Virtual Lab Applications in Supporting Inquiry-Based Biology Learning in Rwandan Secondary Schools: A Case Study of Bugesera District

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Abstract

Guided by the TPACK framework and Constructivist Learning Theory, this study investigated how mobile technology, digital simulations, and virtual laboratories support inquiry-based Biology learning and achievement in resource-limited secondary schools in Rwanda's Bugesera District. A mixed-methods, quasi-experimental design compared experimental and control groups across four schools, involving about 320 Senior One and Two students and eight Biology teachers. Ethical approval was obtained prior to data collection, and all data were gathered under informed consent and strict confidentiality protocols through questionnaires, pre/post-tests, observations, and interviews. Laptops and smartphones were widely available, though internet connectivity and tablets remained limited. Students using PlantNet, simulations, and virtual laboratories achieved significantly higher gains, rising from 45.80 to 75.96 compared to 45.19 to 57.53 in the control group, with all three tools emerging as significant predictors of achievement. Connectivity, device shortages, large class sizes, and inadequate teacher training were the main constraints. Because these conditions are common across under-resourced districts in Rwanda and the wider East African region, the findings support scaling the recommended technology investments into national and regional education policy to strengthen Biology learning outcomes more broadly.

Keywords: *Mobile technology, digital simulations, virtual laboratories, inquiry-based learning TPACK, academic achievement, Biology education, Rwanda.*

4. Using GPT4All, a Locally-Installed AI Coding Assistant, to Improve Debugging Skills and Confidence Among Secondary School ICT Students

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Abstract

Debugging remains a cognitively demanding aspect of learning to program, particularly for secondary students who lack scaffolding to interpret error messages or systematically isolate faults. While cloud-based AI coding assistants show promise, internet dependence, costs, and privacy concerns limit their feasibility in resource-constrained schools. Aligned with the TELLS Partnership's focus on digital innovation and Rwanda's sustainable ICT integration frameworks, this study investigates GPT4All a free, open-source, offline large language model as a local debugging support tool. The study employs a mixed-methods design involving 98 Computer Science students (Years 4 -- 6) at GS Rubaya TSS using GPT4All during Python exercises over three months. Debugging proficiency will be measured via pre- and post-intervention assessments analyzed using paired t-tests, while changes in self-efficacy will be evaluated through validated surveys using descriptive and inferential statistics. Qualitative student reflections and classroom observations will supplement quantitative data through thematic analysis to examine AI engagement patterns and problem-solving independence. As this is a planned study, empirical quantitative and qualitative data will be gathered once the study is implemented. Anticipated results indicate measurable improvements in students' debugging accuracy, speed, and confidence, alongside pedagogical strategies to prevent AI over-reliance. The findings will offer practical guidance for integrating privacy-preserving, offline AI tools into secondary ICT curricula in under-resourced environments.

Keywords: *AI coding assistants, GPT4All, debugging, secondary education, ICT, self-efficacy, local LLMs, computer science education*

5. Assessing the Influence of Digital Transformation on Teaching and Learning in Higher Education

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Abstract

Digital transformation has become a central component of contemporary higher education, reshaping teaching practices and learning experiences through the integration of digital technologies. While many higher education institutions have adopted digital tools and platforms, evidence regarding how specific dimensions of digital transformation contribute to teaching and learning remains limited. This proposed study aims to assess the perceived influence of digital transformation on teaching and learning in higher education, focusing on three key dimensions: digital infrastructure, digital pedagogy and digital competence. This integrated examination of multiple dimensions of digital transformation provides a comprehensive perspective on how digital initiatives shape teaching and learning experiences in higher education. A mixed-methods design will be employed involving university lecturers and students from selected higher education institutions. Quantitative data will be collected through structured questionnaires, while qualitative insights will be gathered through interviews and classroom observations. The study will involve approximately 200 students and 20 lecturers from selected public and private higher education institutions in Rwanda, using purposive and stratified sampling techniques to examine perceptions of how digital transformation affects teaching effectiveness, student engagement and learning outcomes. Quantitative data will be analyzed using descriptive and inferential statistics, while qualitative data will be analyzed thematically. The study expects to find positive associations between digital transformation and the quality of teaching and learning. Adequate digital infrastructure, effective digital pedagogical practices and strong digital competencies are anticipated to contribute to increased student engagement and improved learning experiences. The study will also identify institutional factors that facilitate or hinder successful digital transformation initiatives. The findings are expected to contribute to the growing literature on digital education by providing evidence from higher education institutions and offering practical recommendations for educators, institutional leaders and policymakers. Ethical considerations, including informed consent, confidentiality and institutional approval, will guide all stages of the research.

Keywords: *digital transformation, digital infrastructure, digital pedagogy, digital competence higher education, teaching and learning*

6. Digital Education, AI and Learning Technologies: Exploring the Student-Facing Human-Capacity Dimension of Institutional Artificial Intelligence Resilience among Medical and Health Sciences Students in Rwanda

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Abstract

Artificial intelligence (AI) resilience is an institution's capacity to benefit from AI-enabled change while maintaining educational quality and managing associated risks. This study explored the student-facing human-capacity and pedagogical-integration dimension at the University of Rwanda rather than overall institutional resilience. In this exploratory qualitative study, we conducted semi-structured interviews with 30 purposively selected medical and health sciences students who had used ChatGPT. Guided by the Technology Acceptance Model, seven criteria were examined: academic uses; tasks where ChatGPT performed effectively and less effectively; perceived benefits; perceived risks; suggested improvements; and future healthcare applications. Data were analyzed thematically using deductive and inductive coding. All participants used ChatGPT for class-related tasks; 16/30 also reported professional uses and 6/30 extracurricular uses. Participants considered it effective for class tasks (30/30), particularly literature reviews (15/30) and assignments (14/30), but identified limitations in scientific computing and data visualization (10/30). Reported benefits included productivity (30/30) and skills or knowledge enhancement (27/30). Risks included overreliance and negative learning habits (24/30), impaired learning or critical thinking (17/30), reliability or accuracy problems (13/30), and academic-integrity concerns (4/30). Improvement priorities were data quality and trustworthiness (21/30), flexibility (16/30), policy and training (4/30), and affordability (3/30). Participants anticipated uses in clinical decision-making and efficiency (23/30), knowledge generation (8/30), and policy support (2/30). Student adoption and perceived usefulness were high, but these coexisted with critical-appraisal, responsible-use, and institutional-guidance gaps. Strengthening this bounded dimension of AI resilience requires student AI-literacy training, redesigned assessments that protect critical thinking and academic integrity, and clear responsible-use policies. Overall institutional AI resilience cannot be inferred from student interviews alone and requires future assessment of faculty, leadership, governance, infrastructure, equity, and data systems.

Keywords: *ChatGPT; institutional AI resilience; human capacity; digital education; medical education; Rwanda*

7. Artificial Intelligence Competence among Teacher Trainees in Rwanda and Uganda: Implications for Future Teacher Education

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Abstract

Artificial Intelligence (AI) is rapidly reshaping educational practice, creating an urgent need to prepare teachers with competencies for ethical and pedagogically meaningful AI integration. This study compared AI competencies among teacher trainees in Rwanda and Uganda using the UNESCO AI Competency Framework for Teachers. A comparative cross-sectional survey involved 210 teacher trainees, comprising 105 from the College of Education, University of Rwanda, and 105 from Kyambogo University, Uganda. The questionnaire assessed five AI competency domains: (1) human-centred mindset, (2) Ethics of AI, (3) AI foundations and understanding, (4) AI pedagogical competencies, (5) professional learning and collaboration, AI implementation and adaptation. Further on, the study examined awareness and use of AI tools for teaching and class preparation, learning and student engagement, assessment, and research and data analysis. Quantitative data were analysed using descriptive statistics and comparative analysis, while open-ended responses were thematically analysed. Ethical procedures, including voluntary participation and confidentiality, were observed. Rwanda recorded higher mean scores across all five competency domains: human-centred mindset and ethics (3.37), AI foundations and understanding (3.36), AI pedagogy (3.37), professional learning and collaboration (3.38), and implementation and adaptation (3.53), compared with Uganda's 3.06, 2.70, 2.88, 3.09, and 2.83, respectively. Awareness of general-purpose AI tools was also higher in Rwanda, including ChatGPT (91.4% vs. 78.1%), Gemini (83.8% vs. 41.9%), and Copilot (93.3% vs. 15.2%). Frequent use of ChatGPT was 43.8% in Rwanda and 33.3% in Uganda. Specialized AI use remained limited: no Ugandan trainee reported frequent use of the selected assessment tools, while ChatPDF was the only research tool frequently used in Uganda (3.8%). The findings indicate substantial differences in AI competence and tool exposure and underscore the need for curriculum integration, practical training, and institutional support for responsible AI use in teacher education.

Keywords: *Artificial Intelligence, Teacher Education, Digital Competence, Teacher Trainees, Rwanda, Uganda.*

8. Enhancing Pedagogical Practices through Digital Solutions: Comparative Evidence from Teacher Trainees in Rwanda and Uganda

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Abstract

Digital transformation is central to educational improvement, yet effective technology integration depends largely on teachers' pedagogical competence and institutional readiness. This study examined digital pedagogical competence among teacher trainees in Rwanda and Uganda to inform sustainable and transformative education. A convergent mixed-methods design was employed involving 210 teacher trainees selected through stratified random sampling by year of study: 105 from College of Education, University of Rwanda, and 105 from School of Education, Kyambogo University, Uganda. Data were collected using a researcher-developed 21-item questionnaire measuring five dimensions on a five-point Likert scale: lesson planning and preparation, instructional delivery, assessment and feedback, classroom organization and management, and professionalism and digital competence, plus open-ended prompts on experiences, barriers, and recommendations. Validity was established by two educational technology experts and pilot testing. Reliability (n=210) was excellent: lesson planning α=.878, instructional delivery α=.880, assessment α=.864, classroom organization α=.921, professionalism α=.898, overall α>.80. Ethical clearance was obtained from both universities with voluntary participation, informed consent, and anonymity. Welch's t-tests indicated Rwandan trainees scored significantly higher in lesson planning $t=2.43$, $df=189.4$, $p=.016$, $d=0.34$, instructional delivery $t=3.65$, $df=187.8$, $p<.001$, $d=0.50$, assessment and feedback $t=3.37$, $df=181.1$, $p<.001$, $d=0.46$, and classroom organization $t=5.08$, $df=195.5$, $p<.001$, $d=0.70$, while professionalism did not differ $t=1.30$, $df=200.9$, $p=.197$, $d=0.18$. Qualitative findings revealed barriers: unreliable internet, inadequate ICT infrastructure, limited devices, electricity challenges, and insufficient practical training. Participants recommended increased infrastructure investment, continuous digital skills training, practical teaching experiences, and supportive institutional policies to strengthen digital pedagogy across Africa.

Keywords: *Digital Pedagogy, Teacher Education, Digital Competence, Teacher Trainees, Rwanda, Uganda*

9. Assessing the Impact of AI-Powered Personalized Learning Systems

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Abstract

The integration of Artificial Intelligence (AI) into higher education is accelerating the use of personalized learning systems that adapt instructional content, provide real-time feedback and support data-informed teaching. Current research indicates that adaptive learning can improve student engagement, learning efficiency and academic performance. However, findings remain inconsistent across educational contexts and important gaps persist. Existing studies often focus on the technological capabilities of AI-powered learning systems rather than their actual impact on undergraduate students' engagement, academic performance and learning experiences, particularly within higher education institutions in developing countries. In addition, the combined influence of personalized AI learning and students' perceptions of such systems remains insufficiently understood. Ethical concerns, particularly data privacy, transparency and algorithmic bias, also require further empirical investigation. This position paper presents the rationale for a proposed mixed-methods study designed to address these gaps. The study will examine whether AI-powered personalized learning systems are associated with improved academic performance and student engagement, while also exploring how undergraduate students experience and perceive AI-supported instruction. Quantitative learning-analytics data will be used to assess learning outcomes and engagement patterns, while qualitative interviews will provide insight into students' experiences, perceptions and concerns. The study will also examine ethical issues surrounding the use of student data and algorithmic decision-making. By combining measurable educational outcomes with students' perspectives, the proposed research seeks to provide a more comprehensive understanding of both the benefits and challenges of AI-powered personalized learning. The findings are expected to contribute evidence for responsible AI adoption, inform pedagogical practice and support evidence-based policy development in higher education.

Keywords: *Adaptive Learning, Higher Education, Artificial Intelligence, Undergraduate Students, Learning Analytics*

10. Barriers to the Adoption of Artificial Intelligence Tools for Lesson Planning among Secondary School ICT Teachers in Rwanda

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Abstract

Artificial intelligence (AI) tools such as ChatGPT, Gemini, Copilot and Magic School AI are changing how teachers prepare and deliver lessons by helping them save time, design activities and prepare assessments. Despite these benefits many ICT teachers in Rwanda do not use AI tools regularly for lesson planning. This study will investigate the barriers preventing secondary school ICT teachers in Rwanda from adopting AI tools for lesson planning. Understanding and addressing these barriers is essential for advancing transformative education, promoting lifelong learning and supporting the wider goals for sustainable development through digital innovation in teaching. This study will use a mixed methods design, combining quantitative and qualitative approaches. Data will be collected from approximately 150 ICT teachers selected from purposive sample of secondary schools across selected districts in Rwanda, using questionnaires and semi-structured interviews. Quantitative data will be analyzed using descriptive and inferential statistics while qualitative data will undergo thematic analysis. The study will be guided by the Unified Theory of Acceptance and Use of Technology (UTAUT), which examines how performance expectancy, effort expectancy, social influence, and facilitating conditions influence technology adoption (Venkatesh et al., 2003). Ethical approval will be sought from the relevant institutional review board and informed consent will be obtained from all participants before data collection. The study is expected to identify key barriers, including limited knowledge and skills, inadequate training, poor internet connectivity, limited access to digital devices, concerns about accuracy and reliability of AI- generated content, data privacy issues and absence of clear institutional policies on AI use. It will also explore teacher's perceptions of AI and propose strategies for its effective integration into lesson planning. Findings will inform the Ministry of Education, Rwanda Education Board, school leaders, teacher training institutions and policymakers, contributing to evidence-based AI integration in Rwanda and across African educational systems.

Keywords: *Artificial Intelligence, Lesson Planning, ICT Teachers, Technology, Adoption, UTAUT, Rwanda*

11. Building AI-Ready Universities: Institutional Readiness for Transforming Teaching, Learning, and Research in Higher Education -- A Case Study of Gulu University, Uganda

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Abstract

Artificial Intelligence (AI) is increasingly transforming higher education through its influence on teaching, learning, assessment, research, and institutional decision-making. However, meaningful and responsible AI transformation requires more than adopting digital tools; it depends on institutional readiness, including strategic leadership, supportive policies, ethical governance, digital infrastructure, and human capacity development. Informed by the researcher's experience as a TELLS-supported PhD scholar at Makerere University, this study extends lessons on transformative education, institutional capacity building, and future-oriented higher education to examine the readiness of Gulu University, Uganda, for responsible AI integration in teaching, learning, and research. The study employed a qualitative case study design, using document analysis and semi-structured interviews with academic leaders, ICT personnel, academic staff, research supervisors, and postgraduate students. Data were analysed thematically to identify AI opportunities, institutional challenges, and strategies for sustainable adoption. Ethical approval and informed consent were obtained, with confidentiality, anonymity, and voluntary participation maintained. Findings indicate that Gulu University has digital foundations that provide opportunities for AI integration, particularly in personalised learning, assessment, research support, doctoral supervision, academic writing, and knowledge creation. However, AI transformation remains emergent due to limited AI competencies, uneven digital access, inadequate AI governance, and concerns regarding ethical use and data governance. These findings informed an AI-ready university framework comprising five interconnected pillars: AI governance, AI-enhanced pedagogy, AI literacy development, AI-enabled research, and strategic partnerships for digital infrastructure and innovation. The study demonstrates that building AI-ready universities requires holistic institutional transformation aligning technology, people, policies, and educational priorities. The insights gained through the TELLS-supported doctoral experience at Makerere University provide a valuable foundation for understanding how institutional capacity building and transformative education can inform responsible AI adoption at Gulu University. The proposed framework offers a context-sensitive and adaptable model for African universities seeking to strengthen AI readiness, research capacity, and sustainable higher education transformation.

Keywords: *Artificial Intelligence; Digital Transformation; Higher Education; AI Readiness; Learning Technologies; Institutional Change; Research Capacity Building; Doctoral Education; Transformative Education*

12. Towards Inclusive Digital Learning in Higher Education: A Design-Based Study at Makerere University

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Abstract

This study examined the status of digitally inclusive learning practices at Makerere University to inform the development of inclusive digital learning objects for students with disabilities. Although the University enrolls more than 150 students with disabilities and has invested in digital learning infrastructure, many learners continue to experience barriers in accessing online learning materials. The study established baseline evidence on lecturers' capacity to design inclusive digital content, students' experiences in accessing digital learning materials, and the institutional and technological factors influencing inclusive digital learning. An Education Design-Based Research (EDBR) approach was adopted, with the study representing the problem identification phase. The study equally employed both qualitative and quantitative approaches to data collection and analysis. Findings revealed significant gaps in knowledge, skills, and institutional support for inclusive digital learning. Although 93.3% of lecturers reported developing digital course materials, an equal proportion had never received training in inclusive digital design, suggesting limited integration of accessibility considerations into content development. Furthermore, 86.7% were unfamiliar with accessibility frameworks such as Universal Design for Learning (UDL) and Web Content Accessibility Guidelines (WCAG). From the students' perspective, 35.7% reported using assistive technologies while technical staff estimated that only about 40% of accessibility features available on the University's LMS. Despite these gaps, institutional leadership support, established digital infrastructure, and lecturers' willingness to adopt inclusive practices provide a foundation for improvement. The study recommends targeted capacity-building, enhanced utilization of existing accessibility features, and institutional guidelines to strengthen digitally inclusive learning in higher education.

Keywords: *Disability, Accessibility, Inclusivity, and Digital Learning*

13. Generative AI-Enabled Quality Assurance in Learning Assessment: A Comparative Study of Teacher Training Institutions in Rwanda

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Abstract

Rwanda's national AI policy (MINICT, 2022) and Higher Education Council's 2025 GenAI guidelines (HEC, 2025) position higher education as central to workforce readiness, yet uncertainty persists on reconciling GenAI use with academic integrity, especially in teacher training programmes shaping future educators. Safeguarding academic quality requires clear GenAI guidance for learners, redesigned assessment methods for lecturers, and continuously updated integrity policies and infrastructure from institutions. Key questions persist: how are learners and lecturers prepared to use GenAI responsibly to enhance quality assurance, how do quality assurance practitioners perceive institutional compliance with national guidelines, and how are institutions ready to integrate GenAI into assessment practices? This study intends to address these body of knowledge gaps through a qualitative approach and comparative case study design across four Rwandan higher learning institutions (one public, three private) training pre-service teachers in Biology and Chemistry education. Hence, the study will be grounded in interpretivist philosophy and social connectivism learning theory (Alam, 2023; Siemens, 2005) and the Intelligent-Technology Pedagogy And Content Knowledge (I-TPACK) framework (Celik, 2022). This study will respond to three objectives: (1) examining the dimensions and determinants of GenAI literacy among learners and academic staff and their effect on quality assurance; (2) exploring quality assurance practitioners' perceptions of institutional compliance with regulatory guidelines on AI use for academic purposes; and (3) assessing institutional readiness to integrate GenAI into learning assessment to sustain the quality assurance. Semi-structured interviews, focus group discussions, and document analysis techniques will be used to collect data, with trustworthiness ensured through triangulation, participant cross-checking, and peer scrutiny. Findings shall offer empirical evidence to inform a GenAI-enabled quality assurance framework, guiding policymakers and institutions on academic integrity.

Keywords: *Artificial Intelligence, Learning assessment, Quality assurance policy compliance*

14. Ethical and Equity Considerations of Artificial Intelligence Use in Rwanda's Higher Education: Governance Lessons from the TELLS Partnership.

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Abstract

Artificial Intelligence (AI) is progressively transforming higher education across Africa, shaping teaching, learning, assessment, and research supervision. Within Rwanda's higher education sector, AI adoption remains inconsistent, exposing infrastructure gaps between rural and urban universities, disparities in staff and student digital literacy, algorithmic bias, data privacy concerns, and weak institutional governance. The TELLS partnership demonstrates that sustainable digital transformation depends on deliberate cross-institutional collaboration, shared quality standards, and lifelong learning support; this study extends that lesson to AI governance, arguing that equitable AI integration in Rwanda calls for the same coordinated, multi-institutional approach that has underpinned TELLS' own institutional transformation. The study adopts a convergent mixed-methods design across two purposively selected public and two private universities in Rwanda, spanning urban and rural locations to compare infrastructure and adoption levels. A representative sample of approximately 180 respondents, purposively drawn from lecturers, postgraduate supervisors, students, and ICT administrators, will complete structured questionnaires, complemented by semi-structured interviews with 20 purposively selected participants. Institutional AI-related policies and infrastructure records will also be reviewed. Quantitative data will be analyzed statistically, while qualitative data will be examined thematically to identify recurring patterns across institutions. Findings are expected to show disparate AI adoption favoring better resourced urban universities, digital skills gaps limiting equitable access, and a near absence of formal ethical guidelines governing privacy, bias, and accountability. Beyond documenting these gaps, the study proposes a concrete, multi-institutional AI governance framework modeled on the TELLS partnership's collaborative structure: a joint inter university AI policy taskforce, minimum equity standards for AI tool access, mandatory AI literacy training for staff and students, and a shared oversight body monitoring transparency and accountability. Such a framework would help Rwanda's higher education sector shift from fragmented, reactive approaches toward a systematic, coordinated, and responsible AI governance model.

Keywords: *Artificial Intelligence (AI); Higher Education; AI Governance; Equity; Digital Divide; Institutional Partnership; Digital Literacy*

15. Assessing Assistive Technology Skills and Digital Self-Efficacy among Students with Visual Impairments at University of Rwanda: Implications for Inclusive Academic Learning

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Abstract

Effective use of assistive technologies is essential for enabling students with visual impairments to access academic resources and participate independently in higher education. This study assessed assistive technology access, digital skills, and digital self-efficacy among students with visual impairments at the University of Rwanda. A quantitative cross-sectional design was employed, using a structured questionnaire administered to 53 students with visual impairments. Descriptive statistics, including means and standard deviations, were used to assess students' perceptions of access to assistive technologies and their digital competencies, while Pearson correlation analysis examined the relationship between technology access and digital skills. The findings showed a moderate level of access to digital and assistive technologies (M = 3.46, SD = 0.83). In addition, students reported relatively moderate levels of digital skills and self-efficacy (M = 3.25, SD = 0.75) on a five-point scale. Students reported particularly strong abilities in searching for academic information online (M = 3.69), using email for academic communication (M = 3.54), and creating and editing digital documents (M = 3.46). However, access to regular assistive technology training was comparatively low (M = 2.92), and the provision of accessible digital learning materials also remained a concern (M = 3.15). A significant positive correlation was found between access to digital/assistive technologies and students' digital skills ($r = .681$, $p < .001$). The findings suggest that better access of digital device is associated with stronger digital competence. The findings highlight the need for universities to strengthen assistive technology training, accessible digital learning resources, and institutional support to promote meaningful and inclusive digital participation among students with visual impairments.

Keywords: *Assistive technology; digital skills; digital self-efficacy; visual impairment; inclusive education; higher education.*

16. Réguler la collaboration: des scripts flexibles pour soutenir les interactions écrites de résolution de problèmes complexes dans une communauté d'apprentissage

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Résumé

Les démarches de co-construction de connaissances soutenues par des plateformes numériques restent marginales dans l'enseignement supérieur en Afrique francophone. C'est ce qui fonde la problématique de cette recherche, conduite à l'Université Gaston Berger de Saint-Louis (Sénégal) : engager des groupes d'étudiants en licence, peu familiarisés avec les démarches collaboratives, dans des interactions écrites de qualité autour de problèmes complexes. L'objectif est d'analyser comment des scripts flexibles permettent de réguler la collaboration et de soutenir ces interactions au sein d'une communauté d'apprentissage, en s'appuyant sur la théorie du Knowledge Building (KB) et le champ du Computer-Supported Collaborative Learning (CSCL). Suivant la méthodologie du Design-Based Research, trois itérations ont été menées entre 2015 et 2019 auprès de trois cohortes de Licence 3 en sciences de l'éducation (27, 37 puis 39 participants), réparties en équipes de trois à quatre membres dans deux situations hybrides supportées par Knowledge Forum et Moodle. Des scripts flexibles à faible degré de prescription, complétés par des échafaudages précisant les intentions d'écriture, ont été ajustés par affinement progressif. La qualité des interactions a été appréciée par analyse de contenu (NVivo), triangulée avec un tableau de monitoring, le Knowledge Building Portfolio et le questionnaire Community of Inquiry. Trois résultats se dégagent : la mise en place des scripts est associée au déclenchement et au maintien des échanges (de 280 à 916 notes entre les itérations 2 et 3, soit +227 %) ; l'usage des échafaudages progresse de 239 à 731 occurrences (+68 %) et se diversifie ; le discours évolue d'opinions individuelles vers des constructions collectives. Au-delà du contexte de l'Université Gaston Berger, ces scripts contribuent à des démarches transformatrices dans les contextes à ressources limitées, car ils sont abordables, transférables, adaptables et durables. Couplés au Knowledge Building, ils transforment la résolution de problèmes complexes en une opportunité d'apprentissage collectif.

Keywords: *scripts collaboratifs; Knowledge Building; CSCL; échafaudage; résolution de problèmes complexes; enseignement supérieur africain*

17. Impact of integrating assistive technology into Rwandan education system

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Abstract

Rwanda has made significant progress toward inclusive education, yet learners with disabilities continue to face persistent barriers to full participation, including limited infrastructure, inadequate teacher training, high costs of assistive devices, and weak policy enforcement. Assistive technology (AT) offers a pathway to transformative, inclusive education by driving digital innovation, expanding lifelong learning opportunities for learners with disabilities, and advancing the sustainable development of education systems in Rwanda. Despite Rwanda's commitment to inclusive education, limited empirical evidence exists on the educational impact of assistive technology across different categories of disabilities, particularly on how it shapes participation, accessibility, and learning outcomes in everyday classroom practice. This study aims to investigate the impact of assistive technology on learners' participation, accessibility, and learning outcomes, while identifying the institutional, technological, and human factors that influence its effective integration into Rwandan secondary schools. The study will employ a mixed-methods design, drawing on a purposive sample of approximately 50 teachers, disability support coordinators, and school administrators across 20 selected secondary schools in Rwanda representing varied resource levels and disability categories. Data will be collected through structured surveys and semi-structured interviews exploring current AT practices, institutional readiness, and perceived barriers to integration. Quantitative data will be analysed descriptively and inferentially, while qualitative data will undergo thematic analysis. The study expects to identify variations in assistive technology use across institutions and to demonstrate that effective integration depends on teacher preparedness, institutional support, and resource availability, including low-bandwidth, offline-friendly solutions suited to under-resourced schools. By generating evidence-based insights into AT integration, the study will contribute new knowledge to inclusive education policy, educational technology practice, and teacher professional development in Rwanda. These findings offer lessons relevant to the TELLS partnership, informing strategies for digital transformation, technology-enhanced learning, and institutional capacity building, while supporting a coordinated, sustainable approach to scaling assistive technology across Rwandan schools.

Keywords: *Assistive technology, Inclusive education, Technology-enhanced learning, Rwanda, Disability.*

18. Co-Creating Inclusive Online Learner Support: An Educational Design-Based Research Approach to Academic Staff Development

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Abstract

The expansion of online learning in higher education has heightened the imperative for accessible, responsive, and inclusive learner support, yet many institutions lack contextually grounded staff development and practical resources to address diverse learning needs and disabilities. This ongoing Educational Design-Based Research (EDBR) study at Makerere University, Uganda, seeks to co-design, implement, evaluate, and refine a staff-development intervention for inclusive online learner support. Grounded in andragogy and Vygotsky's social constructivism, the study follows Reeves' iterative DBR model, integrating stakeholder perspectives with empirical evidence to refine interventions and generate contextually grounded design principles. Initial analysis revealed a substantial preparedness gap: although 84.6% of lecturers reported awareness of inclusive teaching and learning, only 23.1% recognized learners with special needs in their classes, while only 15.4% profiled learners. Significantly, all lecturers (100%) identified training in inclusive learner orientation, teaching, and assessment as a priority for professional development. These findings informed the collaborative development of a short online course. Iterative validation of the course involved several stakeholders, including learners with disabilities, and led to content updates. The next DBR cycle will involve integrating stakeholder feedback, uploading the course onto the Makerere University eLearning Environment (MUELE), a Moodle-based Learning Management System (LMS), implementation, evaluation, and evidence-based refinement. This study contributes to scholarly knowledge and practice by suggesting that contextually grounded consultative co-creation as a design principle can advance sustainable, disability-inclusive digital education and strengthen institutional capacity for inclusive learner support in resource-constrained higher education environments.

Keywords: *Educational Design-Based Research; Reeves' Design-Based Research model; inclusive online learning; learner support; disability inclusion; eLearning; academic staff development; co-creation; MUELE; higher education; design principles; Vygotsky's social constructivism*

19. Generative AI as co-teaching partner in pre-service teacher education: Enhancing statistics teaching competencies for primary schools

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Abstract

Statistics teaching in primary schools is usually constrained by teaching methods and lack of confidence for teachers. Generative artificial intelligence (Gen AI) is expected to assist in solving this problem. But there is a limited use of GenAI as co-active teaching partner in preparing pre-service teachers in statistics. This study explored how GenAI can work as co-teaching partner in helping pre-service teachers plan and provide better statistics lessons. This study explored how GenAI as co-teaching partner support pre-service teachers to plan and deliver statistics lessons in primary schools. A mixed methods action research design with 45 pre-service primary teachers over four weeks intervention, in which pre-service teachers used chat GPT and Claude AI to create lesson plans with real world data, practice addressing common students' misconceptions, and get instant feedback on their teaching methods. Data came from pre- and post-intervention reviews, lesson plan analysis, and observation checklists analyzed descriptively for survey's results and thematically for qualitative data. Results showed determinate increases in statistics content knowledge and technological pedagogical content knowledge (TPACK) along with better teaching confidence, more creative lesson design, and stronger ability to anticipate student misconceptions. Though some raised concerns about GenAI bias and called for more digital literacy training. These results suggest that guided GenAI use can reinforce statistics teaching competences and support for sustainable, technology-enhanced, offering a practical model for embedding AI as active pedagogical partner within teacher education systems in Africa and beyond.

Keywords: *Generative AI, Pre-service teacher education, primary school statistics, co-teaching, technological pedagogical content knowledge (TPACK)*

20. Teachers' challenges, digital tools, and pedagogical practices for effective digital learning implementation in South African schools

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Abstract

The integration of digital technologies into education has transformed teaching and learning globally, yet effective implementation remains a significant challenge, particularly in resource-constrained contexts. Guided by the Technological Pedagogical Content Knowledge (TPACK) framework, this study investigated teachers' digital pedagogical practices, the digital tools they employ, and the contextual factors influencing digital learning implementation in South African schools. A convergent mixed-methods design was adopted, integrating quantitative and qualitative data collected from 149 teachers working in primary and secondary schools across rural, township, semi-urban, and urban settings. Quantitative data were collected through a structured questionnaire and analysed using descriptive statistics, while qualitative responses to open-ended questions were subjected to thematic analysis to enrich and explain the quantitative findings. The findings revealed that although 56% of participants had received professional development in digital learning, most participants (76%) taught in rural schools where infrastructure limitations remain prevalent. Teachers reported positive perceptions of digital learning, highlighting its contribution to learner engagement, collaboration, creativity, communication, and differentiated instruction. Frequently utilised technologies included presentation software, educational videos, online assessment platforms, QR codes, artificial intelligence tools, and collaborative digital applications. However, both quantitative and qualitative findings identified persistent barriers, including inadequate digital infrastructure, unreliable internet connectivity, limited learner access to digital devices, insufficient technical support, time constraints, and uneven access to professional development opportunities. Based on these findings, the study recommends prioritising investment in reliable internet connectivity and digital infrastructure, particularly in rural schools where most participants were located. It further recommends expanding continuous, practice-oriented TPACK-focused professional development to address the proportion of teachers who remain inadequately prepared for digital learning implementation, while strengthening school-based technical support and leadership to sustain technology integration. These evidence-based recommendations provide practical guidance for policymakers, education departments, and school leaders seeking to advance equitable, sustainable, and effective digital transformation in South African schools.

Keywords: *Digital learning, TPACK, mixed methods, teacher professional development, educational technology, digital pedagogy, South Africa.*

21. Integrating ICT into Pre-Service Teacher Education: Endline Evidence of Learning Gains and Classroom Practice Improvement from the PRISM Project in Rwanda's Teacher Training Colleges

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Abstract

Rwanda's Project to Strengthen Primary School Mathematics and Science with the Use of ICT (PRISM) was implemented from 2021 to 2026 by the Ministry of Education, the Rwanda Basic Education Board, the National Examination and School Inspection Authority, and the Japan International Cooperation Agency across all 16 Teacher Training Colleges (TTCs). The project aimed to strengthen the Technological Pedagogical Content Knowledge of student-teachers in Science and Mathematics Education (SME) and Early Childhood and Lower Primary Education (ECLPE) options through interventions including the national REB e-Learning Platform, digital exercise development, and Online Continuous Professional Development (CPD). This paper reports the project's endline evaluation, drawing on a mixed-methods survey covering 16 TTCs, 14 demonstration schools, and 19 host schools. Academic tests were analyzed against baseline using Welch's two-sample t-tests and effect sizes, classroom practice during school attachment was rated on a five-point observation tool, and focus group interviews with student-teachers, mentor teachers, and tutors provided complementary qualitative evidence. All ten subject-cohort groups showed statistically significant learning gains ($p < .001$) with large effect sizes (Cohen's $d = 0.77$-1.82), strongest in Year 2 Mathematics (+28.1 percentage points), while classroom practice scores rose from 2.74 to 3.54, exceeding the project target, and more than half of Year 3 student-teachers surpassed subject benchmarks across all four assessed subjects. Beyond these quantitative gains, qualitative findings pointed to school leadership, timetabling, and collegial CPD as the decisive enabling conditions that translated ICT access into sustained improvements in teaching practice. Together, these findings demonstrate that ICT integration strengthens pre-service teacher learning and classroom practice only when embedded in supportive institutional structures rather than treated as a technical input alone, offering transferable lessons for sustainable teacher education reform in Rwanda and similar contexts.

Keywords: *ICT in education; pre-service teacher training; e-Learning Platform; school attachment; learning outcomes; Rwanda*

22. A Hybrid Learning Analytics Framework for Science Education in Low-Connectivity Contexts

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Abstract

Science education in many Rwandan higher education institutions faces two related constraints: limited physical laboratory access and unreliable internet connectivity, both of which restrict the use of mainstream digital learning tools; existing responses tend to treat virtual laboratories, digitized course content, and learning analytics as separate interventions rather than as parts of one integrated system, leaving institutions without a framework for combining them to fit localconditions. This paper proposes a hybrid framework that layers three components around a single Moodle-based platform: where laboratory activities can be simulated, virtual laboratory tools substitute for scarce physical equipment; where content is better suited to self-study, digitized modules built with tools such as Articulate Storyline deliver instruction directly; and underneath both layers, a predictive analytics component draws on Moodle log data (quiz scores, resource access, and forum participation) to flag learners at risk of falling behind, triggering low-bandwidth interventions such as WhatsApp reminders. A visual decision tree is proposed to illustrate how topics are routed to appropriate instructional layers and how learner activity data can trigger specific low-bandwidth interventions. The paper presents the framework architecture, together with anticipated implementation constraints and potential benefits for low-connectivity Rwandan higher education institutions. As a conceptual and architectural contribution, the framework demonstrates how virtual laboratories, digitized content, and predictive analytics can be combined into one layered system rather than deployed separately, offering a practical and context-sensitive approach to supporting science education where full digitization is neither possible nor desirable. It also provides a basis for future empirical validation and refinement in Rwandan higher education settings.

Keywords: *Learning analytics, virtual laboratories, predictive learning analytics, low-connectivity, WhatsApp notifications*

23. Towards a User-Centered Framework for Mixed Reality Maritime Engineering Training: Design Principles for Immersive Learning Interfaces

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Abstract

The maritime industry faces increasing challenges in maintaining operational safety, equipment reliability, and workforce competency amid growing technological complexity and an aging workforce. Traditional training methods for ship engineers often rely on classroom instruction, manuals, and limited hands-on experience, which may not adequately prepare personnel for operating and maintaining sophisticated onboard machinery. Emerging immersive technologies offer new opportunities to enhance technical training through realistic, interactive, and context-aware learning environments. By combining digital information with real-world environments, MR-based training enables learners to visualize complex systems, practice operational procedures, and receive guided instruction within simulated or simulation enhanced engine room and control room settings. Such environments can support experiential learning while reducing the risks, costs, and logistical constraints associated with training on operational vessels. The paper discusses key design principles of user interfaces to ensure a high-quality user experience within mixed reality environments, examining how instructional content, spatial interactions, visual cues, and system feedback can be structured to support learning in complex engineering spaces. During this research, cognitive load management, information hierarchy, interaction design, navigation support, and the balance between real-world equipment visibility and digital augmentation were explored. By establishing a set of design guidelines for immersive maritime learning systems, we aim to contribute to the development of effective, safe, and user-centered training experiences for ship engineering personnel. Rather than focusing solely on technological capabilities, this research focuses on how user interface and user experience design can influence the effectiveness of immersive learning environments. It proposes a set of design considerations for structuring instructional content, user interactions, and information visualization within mixed reality systems intended for maritime engineering training.

Keywords: *Mixed Reality; Maritime Training; User Experience; User Interface Design; Immersive Learning*

24. Leveraging mobile learning technologies to support university students in laboratory practice self-learning. a state of the arts

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Abstract

The rapid advancement of mobile learning technologies has transformed teaching and learning practices in higher education, offering new opportunities to support students beyond traditional classroom settings. In laboratory-based courses, where practical engagement, experimentation, and self-directed learning are essential, mobile technologies can provide flexible and accessible learning support. This study presents a state-of-the-art review on leveraging mobile learning technologies to support university students' self-learning in laboratory practice. The review examines current scholarly literature on the use of mobile devices, applications, and digital platforms designed to enhance students' independent learning experiences before, during, and after laboratory sessions. The study synthesizes findings related to the pedagogical contributions of mobile learning technologies, including increased learner autonomy, improved access to instructional resources, real-time feedback, collaborative learning opportunities, and strengthened engagement with experimental procedures. Particular attention is given to how mobile learning supports self-regulated learning processes such as planning, monitoring, reflection, and problem-solving within laboratory environments. The review also highlights common challenges reported in the literature, including technological limitations, digital accessibility, instructor preparedness, and the alignment of mobile tools with laboratory learning objectives. Findings indicate that mobile learning technologies hold significant potential to enrich laboratory practice by extending learning beyond physical laboratory spaces and promoting active, student-centered learning. However, effective implementation requires thoughtful pedagogical design and institutional support. This review contributes to the growing discourse on technology-enhanced laboratory education by identifying current trends, research gaps, and future directions for integrating mobile learning into university laboratory practice. The study offers practical insights for educators, researchers, and institutions seeking to improve students' laboratory self-learning experiences through mobile technology.

Keywords: *Mobile Learning, Practical Activities, Self-Regulated Learning*

25. Enhancing University Students' Laboratory Self-Regulated Learning through 5E-Based Mobile Learning.

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Abstract

The development of self-regulated learning (SRL) has become a central objective in higher education because it enables students to take responsibility for planning, monitoring, and evaluating their own learning. In physics laboratory settings, however, traditional instructional approaches often emphasize procedural compliance rather than active knowledge construction, limiting students' opportunities to develop SRL skills and meaningful engagement. At the same time, the increasing accessibility of mobile technologies presents new opportunities to support students' learning beyond the constraints of conventional laboratory instruction. Despite these opportunities, there is limited evidence on how mobile learning integrated with the 5E instructional model can effectively enhance SRL in university physics laboratories, particularly in the Rwandan higher education context. This study aims to enhance university students' laboratory self-regulated learning through the development and implementation of a 5E-based mobile learning framework in the Physics laboratory at Kibogora Polytechnic. Specifically, the study will examine the relationship between existing laboratory instructional practices and students' self-regulated learning skills, design and validate a mobile learning framework grounded in the 5E instructional model (Engage, Explore, Explain, Elaborate, and Evaluate), and determine its effect on students' self-regulated learning skills, laboratory performance, and academic engagement. Guided by a Design-Based Research methodology, the study will iteratively develop, validate, implement, and refine the framework through collaboration with subject experts and end users. Data will be collected using validated self-regulated learning and academic engagement instruments, laboratory performance assessments, classroom observations, and interviews. Quantitative and qualitative data will be analyzed to evaluate the effectiveness of the intervention. The findings are expected to provide empirical evidence on the effectiveness of integrating mobile learning with the 5E instructional model in laboratory education. The study will contribute to the growing body of knowledge on technology-enhanced learning by offering a validated instructional framework that can improve laboratory teaching practices, promote students' autonomous learning, strengthen academic engagement, and enhance laboratory performance in higher education.

Keywords: *Self-regulated learning (SRL); 5E instructional model; Mobile learning; Physics laboratory; Laboratory performance*

26. Who is on the other side of the screen? Investigating Learner Authentication Mechanisms in University of Rwanda's E-Learning Assessments.

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Abstract

As educational technology evolves in higher education, online assessments have become central to quality assurance. However, proving that the person sitting for an exam is the same person who enrolled remains a critical and persistent challenge. Weak or inconsistent authentication and the lack of robust verification mechanisms facilitate cheating and other forms of academic dishonesty, undermining the credibility of digital credentials. Online assessments at the University of Rwanda are delivered through a Moodle-based Learning Management System (LMS), which offers largely limited identity verification, relying on static login credentials and basic logs. This does not provide adequate protection against impersonation or in-exam misconduct. This study investigates the existing authentication mechanisms and critically examines the potential and limitations of AI-powered proctoring tools as a possible avenue for strengthening platform security for online exams. The study adopts a convergent parallel mixed-methods design, whereby quantitative data (from a technical review of the portal's authentication logs and structured surveys of students and academic staff across selected faculties) and qualitative data (from interviews with students and staff) are collected concurrently, analysed separately, and then merged during interpretation. Historical assessment data will also be evaluated to detect patterns of impersonation and authentication failure. These findings will be triangulated with a comparative analysis of AI-powered proctoring solutions, including facial recognition, keystroke dynamics, gaze tracking, and other anomaly-detection approaches compatible with the Moodle environment. While AI-powered proctoring tools offer potential to strengthen identity verification, they also raise concerns that must be weighed alongside their benefits. Beyond data privacy, these include fairness and algorithmic bias for instance, facial recognition systems are known to perform less accurately for people with certain skin tones or facial features, risking unequal treatment of learners as well as accessibility for students with disabilities or limited technology access, and user acceptance among students and staff. It is expected that the study will establish whether existing authentication mechanisms in the current platform are sufficient to verify learner identity and integrity during exams and, where gaps are identified, will propose Moodle-compatible AI-powered proctoring solutions appropriate for the University of Rwanda. This will offer practical guidance for strengthening academic integrity in digital assessments while remaining mindful of cost, infrastructure capacity, fairness, accessibility, and student data privacy.

Keywords: *Learner authentication, Moodle LMS, AI proctoring, academic integrity, e-learning assessments, digital identity verification*

27. Integrating Artificial Intelligence into Digital Learning Technologies: Opportunities and Challenges for Secondary and Higher Education in Rwanda

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Abstract

Digital tools and artificial intelligence (AI) are reshaping teaching and learning worldwide, yet their adoption in Rwandan secondary and higher education remains uneven, constrained by infrastructure gaps, limited teacher preparedness, and unclear institutional policy. Educators today draw on a widening range of AI-supported methods, including gamified assessment platforms (e.g., Kahoot), interactive science simulations (e.g., PhET), generative AI assistants for lesson preparation and pedagogical documentation (e.g., Claude), adaptive learning platforms, AI-powered tutoring chatbots, automated grading and feedback systems, and learning analytics dashboards. As a practicing Physics and Chemistry teacher at the Advanced Level in Rwanda, I have integrated several of these tools into my own classroom practice using Kahoot for formative, gamified quizzes, PhET simulations to make abstract physical and chemical processes visible to learners, and generative AI tools such as Claude to prepare lesson notes, schemes of work, and assessment materials more efficiently. This first-hand experience of both the promise and the practical friction of AI adoption motivates the present study, which examines how AI-supported digital learning technologies can be meaningfully integrated into classroom practice to improve engagement, personalize instruction, and support learners across diverse subject areas, including the sciences. It responds to the TELLS 2026 call to explore innovative approaches that strengthen Future Education systems in the region. A mixed-methods design was used, combining a structured survey of secondary school educators with classroom observations and semi-structured interviews, complemented by the researcher's own reflective practice as a secondary school science teacher. Participants were drawn from schools and higher education institutions engaged in ongoing digital transformation initiatives. Quantitative data on technology access, AI-tool usage, and perceived barriers were analyzed descriptively, while qualitative data from interviews, observations, and practitioner reflection were thematically coded to identify recurring patterns in adoption, pedagogical practice, and institutional support. Findings indicate growing but inconsistent use of AI-powered platforms for content delivery, assessment, and feedback, with the strongest gains reported in learner engagement and formative assessment efficiency. Consistent with the author's own classroom experience, gamified quiz tools such as Kahoot and interactive simulations such as PhET were associated with noticeably higher learner participation and improved conceptual understanding in the sciences, while generative AI assistants such as Claude reduced teachers' time burden in preparing pedagogical documents. Key barriers included insufficient teacher training, unreliable internet connectivity, and limited institutional guidelines on responsible AI use. Educators who received structured training and ongoing technical support mirroring the author's own trajectory from tentative to confident use of these tools demonstrated markedly more confident and effective integration of AI into their teaching. Realizing the potential of AI and digital learning technologies in Rwanda requires coordinated investment in infrastructure, sustained teacher professional development, and clear

institutional policies governing AI use in education. Grounded in both empirical findings and practitioner experience, these results offer practical implications for policymakers, teacher educators, and institutions seeking to build resilient, technology-enhanced learning environments, and contribute to broader TELLS Project goals around digital transformation and future partnerships in education.

Keywords: Artificial intelligence, digital education, learning technologies, generative AI, gamified learning, secondary education, higher education, Rwanda

28. Development of an AI-powered virtual laboratory to enhance science learning in Rwandan secondary schools

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Abstract
Rwanda's Competence-Based Curriculum emphasizes practical, learner-centered science education. However, many secondary schools face limited laboratory resources, large class sizes, and inadequate digital tools for hands-on experimentation in physics, chemistry, and biology. These constraints limit students' conceptual understanding and their ability to apply scientific knowledge to real-world problems. Virtual Reality (VR) and Artificial Intelligence (AI) offer a scalable, safe, and cost-effective alternative for delivering immersive, personalized practical learning. This study proposes a mixed-methods design to develop and evaluate an AI-powered, VR-enabled virtual laboratory aligned with the national curriculum. VR will simulate realistic science experiments within interactive 3D environments, while embedded AI and machine learning algorithms will track individual student performance, diagnose misconceptions, and adapt content to each learner's pace. A pre-test/post-test design will compare control and experimental groups, supplemented by student and teacher questionnaires and interviews to assess usability, engagement, and readiness for adoption. Ethical safeguards, including informed consent, data privacy protection, and inclusive design for learners with diverse needs, will guide data collection and system development throughout the study. The study anticipates producing a functional AI-VR virtual laboratory prototype and expects to demonstrate improvements in student engagement, conceptual understanding, and academic performance compared with conventional instruction, along with insights into teachers' perceptions of adopting immersive, AI-driven tools. By integrating VR immersion with AI-driven personalization, this research offers a contextually grounded, scalable model for practical science education in Rwanda, supporting Rwanda's Vision 2050 digital transformation agenda and the TELLS partnership's priorities on digital pedagogy, artificial intelligence in education, and inclusive learning.

Keywords*: Artificial Intelligence, Virtual Reality, Virtual Laboratory, Adaptive Learning, Science Education, Competence-Based Curriculum*

Poster Presentations

1. An Exploration of Teacher Digital Competency for Promoting Digital Inclusive Education at Makerere University

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Abstract

Although the emergence of digital learning technologies has revitalized education at universities (Leong, 2025), the reality of inclusive digital learning at Makerere University remains a challenge. Research shows that students with visual impairment and other forms of disabilities face barriers that limit their inclusion and full participation in university learning environments (Masiga & Nkabala, 2024; Chitiyo et al. 2025). The current educational technologies, such as multimedia tools, assistive technologies and adaptive learning platforms present opportunities for transformative learning that learners with sensory impairments could benefit. While educational and disabilities policies and practice aim to ensure that inclusive education is achieved, it is critical to understand the teacher digital competences that can promote digital inclusion in higher education. So, this study explores the digital competences that teachers require to promote inclusive digital learning at Makerere University. The study specifically examines the competencies to create inclusive digital curriculum, and integrate inclusive education practices with digital education strategies. A research design based on SALSA framework was used to conduct the theoretical review, with the theoretical guidance of constructivism learning theory and differentiated instruction. The findings show that the teacher requires the digital competences, such as implementing differentiated instruction, designing an inclusive digital curriculum and integrating assistive technologies in eLearning content, to effectively promote digital inclusive education at university. The study contributes to inclusive digital learning, which is necessary for accessibility to knowledge and information that can shape the values and lifestyle of learners with diverse abilities. The article further shows how improving the digital competences of the teachers to match increasing developments in educational technologies can enhance transformative and inclusive education at the university.

Keywords: *Constructivism, Digital inclusion, Differentiated Instruction, Inclusive curriculum, Teacher Competency, University education*

2. Design and Early Evaluation of Mathrone Academy: An Integrated Digital Learning Ecosystem for Rwanda

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Abstract

Many learners in Rwanda face persistent barriers to quality education, including limited access to functional laboratory equipment, qualified tutors, and well-integrated digital learning tools. Mathrone Academy is a browser-based platform built to address these gaps simultaneously, serving primary through secondary students across REB, Cambridge IGCSE, and IB curricula, combining online tutoring, AI-assisted study support, an interactive collaborative whiteboard, virtual STEM laboratories with over 80 curated simulations, and educational resources hub within a single unified environment. Development followed an iterative, user-centered design approach across multiple build cycles, and a structured demonstration and evaluation session was conducted with 15 Masters students in Educational Technology at the University of Rwanda College of Education, Remera Campus, facilitated through the ODEL unit on 6th June 2026, where the platform was evaluated against four criteria: pedagogical relevance, curriculum alignment, technical usability, and accessibility, with feedback collected through guided open-ended discussion and thematically analyzed to identify priority improvement areas. Participants identified the virtual STEM laboratory, collaborative whiteboard, and Video-on-Demand courses as the most useful features, affirming the platform's fit with the Rwandan educational context, and thematic analysis surfaced two priority areas which are UI color accessibility and the absence of learner analytics and both of which were subsequently implemented and verified against the original feedback criteria. These findings suggest that locally developed digital platforms can address multiple educational challenges within a single coherent system, with transferable lessons for other educational systems regarding sustainability through low-cost browser-based architecture, scalability through community-grounded curriculum-specific design, progressive capacity building through embedded tools, and digital inclusion through locally embedded development a model that institutional partnerships and policy frameworks can actively support.

Keywords: *digital learning ecosystem, educational technology, STEM education, Rwanda, virtual laboratory, AI tutor, interactive whiteboard, digital inclusion*

3. Artificial Intelligence-Enhanced Chemistry Education for Transformative Learning:Bridging Conceptual Gaps and Enhancing Student Learning Outcomes in Rwanda

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Abstract

Chemistry is important for scientific understanding and problem-solving, yet many learners struggle with abstract concepts, links between molecular, symbolic, and observable levels, limited visualization, and limited individual support. Although interest in Artificial Intelligence (AI) in education is growing, limited research has examined how AI can address chemistry-specific learning gaps in Rwanda while supporting academic integrity, equity and learner independence. This paper addresses this gap by proposing a context-sensitive framework for AI-enhanced chemistry education. A conceptual review of peer-reviewed literature on AI in education, science and chemistry education, digital pedagogy, personalized learning, and responsible AI was conducted. Sources were selected for relevance and examined thematically to identify pedagogical uses, learning relationships, implementation conditions, and AI-related risks. The review informed a four-part framework: AI-supported explanation and visualization; personalized learning and feedback; teacher-AI collaboration in planning, teaching and assessment; and responsible AI use with human oversight. The framework proposes that these elements may support chemistry learning when linked to clear goals, teacher guidance, verification of AI-generated information, and appropriate assessment. Academic integrity, algorithmic bias, data privacy, over-reliance on generative AI, and the digital divide are treated as cross-cutting conditions for responsible implementation. Its distinctive contribution is linking chemistry-specific learning needs with pedagogical and ethical safeguards within Rwanda's competence-based education context. The framework provides a basis for future classroom research on responsible AI use in chemistry education. It positions AI as support for teachers and learners, not a replacement for teachers, and offers a starting point for inclusive, learner-centred and context-responsive chemistry education in Rwanda.

Keywords: *Artificial Intelligence; Chemistry Education; Digital Pedagogy; Transformative Learning; Personalized Learning; Responsible AI; Rwanda*

4. Virtual Fashion Studios as an Industry-Responsive Framework for Skills Development in Developing Economies

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Abstract

The fashion and apparel industry is undergoing rapid digital transformation. This shift is creating new demands for technical, creative and entrepreneurial skills. However, skills development systems in many developing economies are struggling to keep up. The main challenges include outdated curricula, limited infrastructure, high training costs and weak links between educational institutions and industry. As a result, there is a clear mismatch between what graduates can do and what the labor market expects. To address this gap, this study proposes virtual fashion studios as an industry-responsive framework to improve skills development and workforce readiness. Virtual fashion studios bring together digital design software, 3D simulation tools, online collaboration platforms and industry-standard production processes. Together, these elements recreate professional fashion environments and provide learners with immersive, practice-based experiences. This approach strengthens the link between education and industry needs. A framework grounded in experiential learning theory and current digital teaching methods that focus on active participation and practical application of knowledge is proposed. The study will examine how virtual fashion studios can improve curriculum relevance, increase learner engagement, support skills acquisition and enhance employability in fashion education. A mixed-methods research design will be used. Data will be collected from students, educators, industry practitioners and policy stakeholders in selected developing economies. Questionnaires will provide quantitative data while interviews and document analysis will provide qualitative insights. This will give a full understanding of the effectiveness of virtual fashion studios and what is needed for their implementation. The study will also assess how virtual studios can expand access to quality training by reducing dependence on expensive physical infrastructure. In addition, it will explore key implementation challenges such as digital access, instructor readiness, curriculum integration and industry acceptance of digitally acquired skills. The goal is to develop a practical conceptual framework for integrating virtual fashion studios into technical and higher education, in line with the changing needs of the fashion industry in developing economies.

Keywords: *Virtual Fashion Studios; Skills Development; Digital Fashion Education; Industry-Responsive Training; Developing Economies*

5. Integration of ICT tools in the teaching of English writing skills among Ordinary level students in selected schools in Huye District: Teachers' perception of the current situation and ways forward

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Abstract

In the digitalization era, Information and Communication Technology (ICT) has become central to education, yet its role in teaching English writing skills at the Ordinary level in Rwanda remains underexplored. While national initiatives such as One Laptop per Child and establishing smart classrooms in schools have promoted ICT integration, little is known about how these tools specifically support writing pedagogy. This study investigates the extent to which ICT tools are integrated into teaching English writing skills, analyzing current practices and challenges in Huye District. Based on their teaching experience, out of fourteen teachers of English, eight English teachers from three secondary schools were purposively selected and participated in semi structured interviews. Data were thematically analyzed with attention to ethical protocols. Findings reveal that ICT tools particularly computers, audio devices, and mobile phones enhance learners' vocabulary, spelling, and syntactic awareness. However, persistent challenges include limited ICT infrastructure, unreliable internet connectivity, and insufficient digital pedagogical skills among teachers and students. The study contributes to understanding ICT-supported language pedagogy in Rwanda and highlights implications for teacher professional development, provision of digital resources, and policy alignment. Recommendations include targeted digital pedagogical training, improved connectivity, access to collaborative writing platforms, and sustained teacher support to ensure effective integration of ICT in teaching English writing skills.

Keywords: *ICT integration, English writing pedagogy, teacher professional development*

6. Building Standards-Based Interoperability for Rwanda's Health Information Systems:A Sustainable Approach to Integrating Existing and Innovative Solutions

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Abstract

Rwanda's health digital landscape relies on facility-level EMRs such as OpenMRS and OpenClinic, alongside the National Health Intelligence Center's (NHIC) eBuzima and allied dashboards (CRVS, eLMIS, HWMS); despite investment, the sector faces data duplication, inconsistent reporting, limited interoperability, and digital-skills gaps, and replacing these mature systems is neither cost-effective nor sustainable. This paper presents a standards-based interoperability framework, using a design science approach with OpenHIM/Zato as middleware and a HAPI-FHIR gateway, that connects heterogeneous facility EMRs to the NHIC ecosystem via HL7 FHIR APIs and OpenHIE while embedding digital-skills capacity-building and complying with Rwanda's Law No. 058/2021 on data protection. Clinical data from OpenMRS at Kacyiru Hospital and OpenClinic at Igihozo Medical Clinic were each mapped to FHIR resources via dedicated connectors and transformed into NHIC/eBuzima-compatible payloads; the framework was piloted over three months at two contrasting facilities --- Kacyiru Hospital, a public district hospital in Kigali running OpenMRS, and Igihozo Medical Clinic, a private clinic in Nyanza District running OpenClinic --- using synthetic datasets, measuring duplication rates, latency, completeness, and user satisfaction via structured surveys, alongside capacity-building for health information officers and role-based access, encryption, and audit logging operationalizing privacy and security under the law. The pilot showed operationally significant gains: duplicate entries fell 40%, reconciliation time dropped 60%, and reporting turnaround improved 30%; given the small, synthetic-data pilot, these gains are operational rather than statistically generalizable, and staff reported greater confidence in data quality and readiness to sustain the tools. Leveraging open standards like FHIR and OpenHIE across heterogeneous source EMRs, paired with sustained digital-skills development, offers a sustainable, scalable, secure path to integrating Rwanda's digital health ecosystem, with future scaling dependent on governance, terminology harmonization, and capacity-building to bridge technical and human-resource gaps without replacing proven tools such as eBuzima, OpenMRS, OpenClinic, and NHIC dashboards.

Keywords: *Health Information Systems, Interoperability, HL7 FHIR, OpenHIE, Rwanda, eBuzima, NHIC, OpenMRS, OpenClinic*

Theme II. Emerging Trends in Artificial Intelligence and Machine Learning for Education

Oral Presentations

1. Intelligence artificielle: revue de cadres pour une stratégie sénégalaise inclusive de développement des compétences en IA

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Résumé

Le développement des compétences en intelligence artificielle (IA) est stratégique pour l'Afrique subsaharienne, et la Stratégie nationale de développement de l'IA adoptée au Sénégal en 2023 requiert des cadres et interventions de formation adaptés. Cette revue rapide identifie les cadres politiques, référentiels de compétences et interventions éducatives internationaux mobilisables pour une stratégie sénégalaise inclusive visant cinq publics (étudiants, enseignants-chercheurs, entrepreneurs, décideurs publics, société civile), autour de quatre sous-questions : panorama des cadres, méthodes et résultats des interventions, transférabilité et angles morts. Suivant le Cochrane Rapid Reviews Methods Group et PRISMA 2020, les critères d'éligibilité retiennent les publications de 2018 à 2026, en français ou anglais, portant sur les compétences, cadres ou interventions de formation en IA impliquant des articles scientifiques et document de la littérature grise institutionnelle, hors contenus purement techniques. Quinze sources (onze bases académiques, quatre institutions de littérature grise) ont été interrogées via une requête principale et quatre variantes, sans filtre géographique. Avec l'application Covidence, 2 520 références identifiées, ramenées à 2 195 après dédoublonnage, sont triées en deux passes (titre-résumé puis lecture intégrale) par deux évaluateurs indépendants en aveugle et un troisième arbitre. Puis l'accord est mesuré par le kappa de Cohen sur un pilote de 10 % (environ 200 références, seuil de 0,60). Le critère de transférabilité contextuelle a été formulé autour de 5 sous-critères opérationnels (T1 à T5) : comparabilité socio-économique, reproductibilité, généralisabilité conceptuelle, robustesse de l'évaluation et pertinence stratégique. Les résultats suggèrent une cartographie à la croisée des cinq populations cibles clés définies dans le protocole de recherche (populations PICO) avec les niveaux de maîtrise des référentiels de l'UNESCO et les six dimensions structurelles du contexte sénégalais. Ce qui devrait profiler une base probante pour l'opérationnalisation de la stratégie nationale du Sénégal et une méthodologie reproductible pour l'Afrique francophone.

Abstract

The development of artificial intelligence (AI) skills is strategic for sub-Saharan Africa, and Senegal's National AI Development Strategy, adopted in 2023, calls for suitable training frameworks and interventions. This rapid review identifies the international policy frameworks, competency standards and educational interventions that can inform an inclusive Senegalese strategy targeting five groups (students, faculty, entrepreneurs, policymakers and civil society),

around four sub-questions: framework landscape, intervention methods and outcomes, transferability, and blind spots. Following the Cochrane Rapid Reviews Methods Group and PRISMA 2020, the eligibility criteria retained publications from 2018 to 2026, in French or English, addressing AI skills, frameworks or training interventions and comprising scholarly articles and institutional grey-literature documents, excluding purely technical content. Fifteen sources (eleven academic databases and four grey-literature institutions) were searched using one main query and four variants, without a geographic filter. Using the Covidence application, 2,520 records were identified and reduced to 2,195 after de-duplication; these are screened in two passes (title-abstract, then full-text) by two independent blinded reviewers and a third adjudicator. Agreement is then measured with Cohen's kappa on a 10% pilot (about 200 records, 0.60 threshold). The contextual transferability criterion was formulated around five operational sub-criteria (T1 to T5): socio-economic comparability, reproducibility, conceptual generalizability, evaluation robustness and strategic relevance. The results suggest a mapping at the intersection of the five key target populations defined in the research protocol (PICO populations), the proficiency levels of the UNESCO frameworks, and the six structural dimensions of the Senegalese context. This should outline an evidence base for operationalizing Senegal's national strategy and a replicable methodology for Francophone Africa.

Keywords: *intelligence artificielle; compétences; éducation; revue rapide; Sénégal; transférabilité contextuelle; cadres internationaux.*

Theme III. Research Capacity Building and Doctoral Education

Oral Presentations

1. Predictive maintenance of Gisenyi hydropower turbines through SCADA temperature analysis and an integrated monitoring strategy

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Abstract

Hydropower is a reliable and sustainable renewable energy source with low operating costs, providing stable electricity generation and essential grid support services. In Rwanda, improving turbine condition monitoring is crucial for early fault detection, enhancing reliability, and reducing maintenance challenges. This study aims to improve turbine condition monitoring and predictive maintenance at the Gisenyi Hydropower Plant, a 1.7 MW run-of-river facility equipped with two Francis turbines. Two objectives were considered: (i) assessing turbine health using temperature-based data analysis and (ii) developing a vibration monitoring system for enhanced fault detection and diagnosis. Three months of Supervisory Control and Data Acquisition (SCADA) data collected from June to August 2025 were analyzed, focusing on non-drive-end (NDE) bearing and alternator winding temperatures. Hotelling's T^2 multivariate statistical method was applied to classify turbine operating conditions into normal, alarm, and trip states. The results revealed that Generator 2 consistently operated at higher temperatures than Generator 1, while the absence of a dedicated vibration monitoring system limited early mechanical fault detection. To address this limitation, a vibration monitoring system based on ultrasonic sensing was proposed, where sensor signals are processed through a programmable logic controller (PLC) and integrated into the SCADA platform. The proposed temperature and vibration monitoring framework enables earlier fault detection, improves maintenance planning, and enhances turbine reliability. Furthermore, the study demonstrates the potential of digital monitoring technologies as practical learning tools for TVET and engineering education by supporting hands-on training, digital skills development, and knowledge transfer between academia and industry. Future work will focus on integrating machine learning techniques for automated fault prediction and validating the system using long-term operational data and additional turbine health indicators.

Keywords: *Gisenyi hydropower plant, Predictive maintenance, Supervisory control and data acquisition, Temperature monitoring, TVET education, Vibration monitoring system.*

2. Decolonising Graduate Research Supervision: Indigenous Knowledge Systems in Zimbabwean and Rwandan Universities

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Abstract

Despite calls by students and academic movements to decolonize the curricula, research indicates that postgraduate supervision in sub-Saharan Africa remains dominated by Eurocentric paradigms, that are hierarchical and individualistic. In contrast, Indigenous Knowledge Systems (IKS) utilize African epistemologies grounded in relationality, community-led research, and local ways of knowing. This study investigates how university supervisors in Zimbabwe and Rwanda incorporate IKS into supervisory relationships and student methodology choices, exploring the tension between Eurocentric institutional benchmarks and indigenous epistemologies. The design is qualitative and comparative, drawing on decolonial theory and Ubuntu. Zimbabwe and Rwanda were chosen deliberately: professional networks across both countries enabled access to supervisors willing to speak candidly about their practice. Purposive sampling produced eight research supervisors (four per country) and fifteen recent postgraduates (eight in Zimbabwe, seven in Rwanda). Semi-structured interviews formed the core of data collection, supported by critical discourse analysis of institutional supervision frameworks and completed dissertations. Relational ethics guided the process throughout, and participants' own accounts of IKS shaped how the data were read. Findings show a strong preference for IKS supervisory frameworks rooted in ubuntu and African relational accountability. Participants identified three key approaches: adapting conversational traditions like Zimbabwe's *dare* and Rwanda's *umganda* peer-peer learning; integrating oral narratives and community-embedded ethics and measuring research success by community utility and relational responsibility rather than solely institutional metrics. However, rigid bureaucratic compliance such as standardized thesis templates and citation metrics alongside a lack of formal IKS pedagogical training, continues to compel supervisors to rely defensively on Eurocentric paradigms. The study proposes a conceptual framework for culturally responsive supervision and mentorship. It also recommends policy shifts within regional higher education systems, so that postgraduate research supervision aligns more closely with indigenous epistemologies.

Keywords: *graduate supervision; Indigenous Knowledge Systems (IKS); decolonisation; relational pedagogy; higher education*

Poster Presentations

1. Overcoming the Theory-Practice Divide: Factors Hindering Action Research Implementation among Student Teachers in Rwandan Teacher Training Colleges (TTCs)

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Abstract

Action research is a critical element of the teacher training program designed to bridge the gap between pedagogical theory and classroom practice by helping student teachers develop essential research and problem-solving skills. In alignment with the Competence-Based Curriculum (CBC), the Rwandan Education Board (REB) has designated research as a core component of the Teacher Training College (TTC) curriculum. However, despite its recognised importance in teacher development, the actual implementation of action research in Rwandan TTCs remains limited. Guided by the COM-B (Capability, Opportunity, Motivation and Behaviour) model of behaviour change, this study employed a qualitative research design across three TTCs to identify the barriers to implementing action research and propose strategies for its practical curriculum integration. Data were collected from relevant policy documents; 7 tutors and 33 student teachers selected through purposive sampling. Data collection tools included semi-structured interviews, qualitative open-ended questionnaires and document analysis. All data were collected after obtaining informed concern from participants. Thematic approach was used to analyse and present data. Findings revealed that key barriers fall under specific COM-B dimensions: limited capability (insufficient methodology training and academic writing skills); heavy curriculum workloads, rigid internship schedules, lack of digital research resources and low motivation. Consequently, the study recommends that TTCs should establish structured mentorship frameworks, dedicate protected research hours on the timetable and provide basic research tools to support student teachers in reflective practice.

Keywords: *Action Research, Competence-Based Curriculum (CBC), Teacher internship, Reflective Practice, COM-B Model*

Theme IV. TELLS Project Impact, Lessons and Future Partnerships

Oral Presentations

1. Effect of Gamification on Students' Engagement and Academic Performance in Statistics and Probability among Senior Two Students in Musanze District, Rwanda

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Abstract

Gamification has gained attention as a learner-centred strategy for improving students' engagement and academic achievement, yet evidence from Rwandan secondary mathematics classrooms remains limited. This study investigated the effect of gamification on students' engagement and academic performance in Statistics and Probability among Senior Two students in Musanze District, Rwanda. A mixed-methods approach using a quasi-experimental non-equivalent control group design involved 161 students and 8 mathematics teachers from four public secondary schools. Quantitative data were collected through questionnaires and pre-test and post-test achievement tests, while qualitative data were obtained through classroom observations, teacher interviews, and focus group discussions. Quantitative data were analysed using descriptive statistics, *t*-tests, ANCOVA, regression, and mediation analysis, while qualitative data were analysed thematically. Findings showed that gamification significantly improved students' behavioural, emotional, and cognitive engagement. The experimental group achieved a higher mean gain than the control group (4.95 vs. 2.76), with a statistically significant difference ($p < .001$). After controlling for pre-test performance, gamification remained a significant predictor of post-test achievement ($\beta = 2.68$, $p < .001$). Mediation analysis showed that student engagement partially mediated the relationship between gamification and academic performance. Teachers reported positive experiences, including increased participation, collaboration, confidence, and motivation, although inadequate training, limited resources, large classes, and time constraints constrained implementation. The findings suggest that gamification can strengthen engagement and academic performance in Statistics and Probability and support learner-centred teaching under Rwanda's Competence-Based Curriculum. The study provides context-specific evidence for effectively integrating practical game elements into mathematics instruction while recognising local implementation conditions.

Keywords: *Gamification; mathematics education; student engagement; academic performance; Statistics and Probability*

Poster Presentations

1. Critical analysis of Competence-Based Curriculum implementation in primary and secondary schools of Musanze District, Rwanda

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Abstract

Rwanda adopted the Competence-Based Curriculum (CBC) to improve the quality of Education by developing learners' knowledge, competences, skills, attitudes and values, required to cope with the twenty-first century' requirements. The study examined the implementation of CBC in basic education at schools in Musanze district, Rwanda. Guided by interpretivist paradigm, the study employed qualitative approach and phenomenological research design. From 166 accredited schools in Musanze district, 18 schools were purposively sampled based on their location and type. Thirty-six participants were purposively selected from these schools. Data were collected through documents review and semi-structured interviews, and analysed using thematic analysis. Findings indicated that CBC has enhanced learners' participation, practical learning, and competence development. However, CBC implementation remains constrained by inadequate teaching resources, insufficient teacher preparation, large class size, and limited infrastructures, particularly in public and government-aided schools. Therefore, the study concludes that although CBC has the potential to improve learners' competencies, its effectiveness depends on sustained investment in teachers' professional development, adequate learning resources, and continuous curriculum implementation support. It recommends Rwandan education system to strengthen teachers' continuous professional development, improve instructional resources, regular monitoring of CBC implementation, adapt CBC implementation strategies to schools' contexts and provide differentiated supports to disadvantaged schools.

Keywords: *Competence-Based Curriculum, Curriculum implementation, Teachers' Professional Development, Basic Education, Rwanda*

Theme V. Transferable Skills and Lifelong Learning

Oral Presentations

1. Data-Driven Decision-Making Practices and School Performance in Ruhango District, Rwanda

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Abstract

While school leadership globally increasingly relies on Data-Driven Decision-Making (DDDM) to improve outcomes, this study examined DDDM practices in Ruhango District, Rwanda, and their association with school performance, using the Principal Data-Driven Decision-Making Index (P3DMI). A descriptive quantitative design established a baseline understanding of current practices, given the absence of prior district-level data on DDDM in this context; data were drawn from 407 respondents (95 head teachers, 312 teachers) selected through census, stratified, and simple random sampling. Findings show that although data collection is routine, analysis and use remain weak: instructional planning draws more on attendance records than on national examination results, translating data into action plans is limited, and monitoring and evaluation are weak-to-moderate, with outcome tracking and post-evaluation adjustment particularly underdeveloped. Teachers' statistical capacity is low, and school-wide data dashboards are rarely implemented. As a descriptive study, DDDM's relationship with performance emerges as a directional pattern rather than a causal one: weak, poorly institutionalized practices coincide with lower levels of school performance, evidenced by 70.2% of Government-Aided schools at P6 and 64.3% at S3 in the lowest performance bands. This association is reinforced by limited analytical capacity, ineffective monitoring and feedback mechanisms, and inadequate digital infrastructure concentrated in the lowest-performing schools. This study offers one of the first district-level assessments of DDDM implementation in Rwanda, contributing evidence relevant to Digital Innovation and Sustainable Development in education, and recommends strengthening school leaders' data literacy, expanding digital data management systems, institutionalizing evidence-based planning, and enhancing continuous professional development.

Keywords: *Data-driven decision making; school performance; school improvement; educational leadership; monitoring and evaluation; digital innovation; Rwanda education system.*

2. Transformative education through culturally responsive pedagogy: teaching Rwandan riddles through songs to strengthen Primary Four learner's participation

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Abstract

Transformative education requires pedagogies that reposition learners from passive recipients to active contributors while valuing culture, creativity, and agency. In Rwanda's Competence-Based Curriculum, this orientation is relevant to Kinyarwanda oral literature, where teacher-led instruction can limit participation. This study examined the use of Rwandan riddle songs as a culturally responsive pedagogy to strengthen learner participation in Primary Four classrooms. An explanatory sequential mixed-methods design was employed in two primary schools in Gicumbi District, one rural and one urban. Participants comprised 80 Primary Four learners, two Kinyarwanda teachers, and two head teachers. Purposive and simple random sampling were used. Data were generated through classroom observations, questionnaires, interviews, and focus group discussions. Quantitative data were analyzed using descriptive statistics, while qualitative data were analyzed thematically. Findings indicated that integrating songs with riddles created more participatory classroom interaction. Learners actively engaged in discussions, responded to riddles with greater confidence, collaborated with peers, and showed willingness to participate in oral literature activities. The approach connected classroom learning with Rwandan cultural knowledge, creating an enjoyable and inclusive environment to develop communication, creativity, and social competencies. This study highlights a local pathway for transformative education: recontextualising indigenous oral traditions as interactive learning resources rather than treating them solely as cultural content. Teaching riddles through songs can strengthen learner agency, participation, and meaningful learning within primary education. The study recommends integrating songs, riddles, and other indigenous resources into Kinyarwanda pedagogy and teacher development to advance learner-centred, culturally responsive, and transformative classroom practice.

Keywords: *Transformative education; culturally responsive pedagogy; Rwandan riddles; songs; learner participation; Kinyarwanda; primary education; Competence-Based Curriculum.*

3. Fostering transferable skills through inclusive education in higher Education:

Implications for Rwandan students with Special Needs

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Abstract

Higher education is increasingly expected to cultivate transferable skills such as communication, critical thinking, collaboration and problem-solving, given their role in employability and lifelong learning. Yet students with special needs continue to encounter barriers that restrict their access to these competencies, a challenge that remains under-examined at the tertiary level in sub-Saharan Africa, including Rwanda. While Rwanda's Special Needs and Inclusive Education (SNEI) Policy and Competence-Based Curriculum (CBC) establish a strong normative commitment to equity, little is known about whether and how this policy architecture translates into inclusive practice within university classrooms. This paper addresses that gap by examining how inclusive pedagogy can support competency development for this population in Rwandan higher education institutions. This is a conceptual paper that employs a qualitative synthesis methodology, drawing on a systematic literature review, thematic analysis and policy document review. Findings show that learners with disabilities are frequently excluded from skills-building opportunities due to inaccessible learning environments, lecture-dominated teaching traditions, limited institutional support and deficit-oriented staff attitudes. Universal Design for Learning and differentiated instruction emerge as effective frameworks for making competency development accessible to all learners without lowering academic expectations. The central contribution of the paper is identifying an "operationalisation gap": although Rwanda's policies are rhetorically well-aligned with inclusive, competency-based goals, institutions lack the concrete mechanisms course design guidelines, accessible assessment tools, lecturer preparation and disability support capacity needed to enact them. The paper concludes that closing this gap is an equity, quality and national development imperative, requiring coordinated investment in academic staff training and institutional accountability structures to secure equitable graduate outcomes for all learners.

Keywords: *Transferable skills; Inclusive education; Special needs education; Higher education; Universal Design for Learning (UDL); Differentiated instruction; Lifelong learning; Competence-Based Curriculum (CBC); Rwanda; Employability*

4. Transforming quality instruction through professional reflection and feedback: Evidence from public primary schools in Gasabo District, Rwanda

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Abstract

Transformative education depends on quality instruction that promotes learner-centred, inclusive, and adaptive teaching to foster meaningful learning and critical thinking. Achieving such instruction requires school-based professional reflection-feedback beyond conventional teacher professional development. In this study, professional reflection-feedback comprises teachers' ongoing professional reflection on their instructional practices and constructive feedback from headteachers. Guided by learning-centred leadership theory, this study examined the contribution of professional reflection and feedback to quality instruction in public primary schools in Gasabo District, Rwanda. A mixed-methods research approach was employed. Quantitative data were collected from 99teachers, 37Directors of Studies, and 37headteachers using questionnaires, while qualitative data were obtained through interviews with 15headteachers. Quantitative data were analysed using descriptive and inferential statistics, while qualitative data were analysed thematically. Findings revealed a moderate positive relationship between professional reflection and feedback and quality instruction ($r=0.48$, $p<.01$). Regression analysis indicated that professional reflection and feedback significantly predicted quality instruction ($\beta=0.42$, $p<.01$). The overall regression model explained 62% of the variance in quality instruction ($R^2=0.62$, $F=28.46$, $p<.001$), indicating that professional learning practices are associated with variations in quality instruction. Qualitative findings showed that reflection and feedback practices were constrained by limited time, heavy workloads, inconsistent follow-up mechanisms, and inadequate instructional resources. The study argues that professional reflection and feedback can serve as transformative mechanisms by enabling teachers to critically examine their practices, adapt instruction, and create more responsive learning environments. The study recommends strengthening school-based professional learning frameworks that institutionalise structured reflection, collaborative feedback, and instructional support as pathways for advancing transformative education in similar educational contexts.

Keywords: *Transformative quality instruction, professional development, reflection and feedback, public primary schools, Gasabo District, Rwanda*

5. Instructional Competence of Teachers and Its Impact on Learning Outcomes for Learners with Cerebral Palsy in Rwanda.

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Abstract

Inclusive education for learners with cerebral palsy (CP) continues to present significant challenges in Rwandan schools, like in similar educational contexts in the sub-region. This study sets out to assess the instructional strategies used to support the learners in both inclusive and special education settings in Rwanda. The study was guided by Vygotsky's sociocultural theory, employing a convergent parallel mixed methods design combined questionnaires from 71 teachers in six purposively selected schools, semi-structured interviews with ten teachers and six directors of studies, and observations of four lessons, one in each of four schools. The data were analyzed using SPSS descriptive and inferential statistics, to generate a quantified picture of educators' instructional competencies. The quantitative results indicated a relatively low application of evidence-based instructional strategies, notably the multisensory instructional techniques (9.9%), individualized education plans (42.3%), environmental modifications (46.5%), and assistive technologies (16.9%). In contrast, cooperative learning strategies (62.5%) and the provision of extended time on (63.4%) were more frequently implemented. No assistive technology was used in any observed lesson, and assessment formats were not adapted to learners' needs. Learner records showed mean examination performance rising from 31.2% to 43.1% across two years, $t(16) = 4.31$, $p < .001$, $d = 1.04$, despite the observed improvements, the majority of learners did not meet the requirements for promotion. Qualitative findings revealed that many teachers lacked CP-specific pedagogical knowledge, particularly in adapting instruction, assessment, and learning materials. The study revealed profound inadequacies in professional development and limited institutional support, combining to hinder instructional effectiveness for learners with CP. The study recommends CP-specific professional development, systematic assistive technology provision, and structured teacher-family collaboration.

Keywords: *Academic achievement, cerebral palsy, instructional competence, Rwandan schools,*

6. The Role of Micro-credentials for The Future of Sub-Saharan African Higher Education

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Abstract

Higher education systems in Sub-Saharan Africa (SSA) face increasing pressure to prepare learners with labour market-relevant competencies while expanding access, supporting lifelong learning, and responding to rapid digital and economic changes. Micro-credentials have emerged as flexible, competency-focused learning opportunities that can complement conventional qualifications by recognising specific, assessed learning achievements. This paper examines the role and potential of micro-credentials in transforming higher education in SSA and identifies the conditions under which they can generate credible educational and labour-market value. A rapid evidence synthesis based on Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA2020) was undertaken through targeted searches of peer-reviewed literature, institutional sources, and authoritative African and international policy documents. Evidence was synthesised thematically around conceptualisation, employability, flexible learning pathways, digital transformation, employer engagement, quality assurance, recognition, and policy alignment. The synthesis indicates that micro-credentials can support targeted skills development, continuing professional learning, flexible participation, visibility of competencies, and stronger links between higher education and employers. African evidence, including studies and policy work from East and Southern Africa and continental qualifications initiatives, shows growing institutional and policy interest. However, these benefits are conditional rather than automatic. Persistent challenges include inconsistent definitions, fragmented quality-assurance arrangements, uncertain recognition and credit transfer, limited employer familiarity, digital-access constraints, affordability, and uneven policy frameworks. The paper argues that micro-credentials should complement rather than replace degrees and should be embedded within national qualifications systems and institutional quality-assurance structures. Based on the synthesis, the paper proposes a five-layer African Micro-Credential Ecosystem Framework linking labour-market demand, learning design, quality and trust, recognition and portability, and learner progression. The paper concludes that credible African micro-credential ecosystems require clear competency standards, meaningful assessment, employer co-design, transparent recognition, stackable learning pathways, inclusive digital infrastructure, and continuous evaluation.

Keywords: *Micro-credentials; Digital transformation; Higher education; Lifelong Learning; Sub-Saharan Africa*

7. The Impact of School-Related Stressors on Adolescent Wellbeing in Kumba, Cameroon: Breaking Barriers to Future Learning

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Abstract

Adolescence is characterised by significant neurological and social shifts, making students particularly vulnerable to environmental stressors. This study was motivated by growing concerns regarding how factors such as authority figure abuse, disciplinary trauma, academic pressure, peer victimisation, and social ostracism create a "wellbeing gap" that undermines students' mental and physical health in Kumba, Cameroon. The study adopted an explanatory sequential design **(**mixed-methods**).** Quantitative data were collected from a sample of 394 adolescents drawn from a population of 21,435 adolescent students in Kumba, Cameroon. A stratified random sampling approach was used to select the participants. Qualitative data were obtained subsequently from 10 key informants through semi-structured interviews to provide contextual depth. The targeted school authorities signed consent forms, and assent was obtained from the participants. The findings revealed that all identified school-related stressors have a statistically significant positive relationship with adolescent wellbeing. Academic pressure showed the strongest association with diminished wellbeing ($r = .411$, $p < .001$), driven by unmanageable workloads and the high-stakes surrounding examinations. This was followed by peer victimization ($r = .358$), ostracism ($r = .337$), disciplinary trauma ($r = .278$), and authority figure abuse ($r = .224$). Interview data reveal that, when exposed to stressors, adolescents experience psychological manifestations of distress such as chronic tension headaches, heart pounding, uncontrollable muscle shaking, school phobia, and acute hypervigilance. The study concludes that many secondary schools in Kumba have become significant sources of chronic stress, which severely undermines students' academic engagement, thereby threatening interest in pursuing higher education studies and lifelong learning goals. To foster a healthier learning environment, the study recommends strictly enforcing national bans on corporal punishment and transitioning to trauma-informed and restorative disciplinary practices**.** School administrators should coordinate academic workloads to prevent burnout and integrate stress-management workshops into the curriculum.

Keywords: *School-Related Stressors, Adolescent Wellbeing, Academic Pressure, Disciplinary Trauma, Peer Victimisation, Ostracism.*

8. Headteachers' Supervisory Roles and Teachers' Job Commitment: Unveiling the Mediating Mechanism of Collegiality

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Abstract

Teacher commitment constitutes a foundational determinant of school effectiveness, yet its antecedents in low- and middle-income educational contexts remain insufficiently theorised. Drawing on social exchange theory and instructional leadership scholarship, this study investigates how headteachers' supervisory roles shape four target-specific dimensions of teacher commitment and tests whether teacher collegiality functions as a transmission mechanism. A cross-sectional survey was administered to 338 senior high school teachers in selected senior high schools in Ghana, and Partial least squares structural equation modelling (PLS-SEM) was employed to estimate the measurement and structural models, with 10,000 bias-corrected bootstrap resamples. Headteachers' supervisory roles exhibited a substantial positive influence on teacher collegiality and demonstrated heterogeneous effects across the four commitment dimensions. Teacher collegiality mediated the supervision--commitment relationship in a pattern consistent with the typology of Zhao, Lynch, and Chen (2010): complementary partial mediation for commitment to school and commitment to teaching, indirect-only mediation for commitment to students, and no mediation for commitment to profession. These findings extend social exchange theory to school supervisory contexts by demonstrating that the relational quality among teachers, rather than supervision alone, accounts for the principal pathway through which leadership influence reaches student- and school-focused commitments. The study recommends that the Ghana Education Service should embed peer collaboration in head teacher training and test the model longitudinally across other sub-Saharan African contexts. s

Keywords: *headteacher supervision; teacher job commitment; collegiality; mediation analysis*

9. Continuous professional development as a lifelong learning strategy for enhancing teaching effectiveness in public secondary schools in Rwanda: a case of Kamonyi district

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Abstract

Continuous Professional Development (CPD) is recognized as an important lifelong learning strategy for strengthening teacher competence, improving classroom practices, and enhancing educational quality. Although Rwanda has institutionalized CPD to support teachers and the implementation of the Competency-Based Curriculum, limited evidence exists regarding the specific CPD dimensions that most effectively enhance teaching effectiveness at the district level. This study examined the influence of CPD on teaching effectiveness among teachers in selected public secondary schools in Kamonyi District, Rwanda. A quantitative correlational research design was adopted. Data were collected from 288 teachers selected through simple random sampling of schools and convenience sampling of teachers. Structured questionnaires were used to gather data, which were analyzed using descriptive statistics and multiple regression in SPSS. The findings revealed that CPD has a significant positive influence on teaching effectiveness, explaining 36.3% of the variance in teaching effectiveness ($R^2 = 0.363$, $p < .05$). CPD significantly improved lesson planning, classroom instructional practices, and assessment and evaluation practices. Among the dimensions examined, collaboration and peer learning emerged as the strongest predictors of teaching effectiveness, while CPD content relevance also demonstrated significant positive effects. However, participation frequency alone was not consistently associated with improvements in instructional and assessment practices. The study concludes that the quality, relevance, and collaborative nature of professional development are more important than participation frequency alone. The findings provide practical evidence for strengthening teacher professional learning systems in Rwanda and similar contexts. The study recommends enhancing school-based professional learning communities, context-responsive CPD programmes, and sustained follow-up support to improve teaching effectiveness and promote lifelong learning among teachers.

Keywords: *Continuous Professional Development, Lifelong Learning, Teacher Collaboration, Teaching Effectiveness, Quality Education, Sustainable Development Goal 4, Rwanda.*

10. Teaching Advanced Games User Research: A Case Study

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Abstract

The video game industry, like other technological fields, puts great emphasis on how consumers engage with interactive products. Games User Research (GUR) helps developers evaluate player experiences, identify usability and playability issues for improving game design through evidence-based methods. As the video game industry continues to grow, higher education is challenged in properly preparing learners with the theory and practical competencies necessary for professional work. Effective educational approaches to GUR are essential for supporting transformative learning, building competencies that will remain useful throughout learners' professional careers. This work investigates how higher education can prepare learners for professional practice in Games User Research. Using an action research approach, the work explores learning experiences within the MM-504 User Experience Evaluation course in the Master's Programme in Multimedia and Game Technologies at the University of Agder (Norway). In this study, learners are put through practical group projects, while applying established research methods and tools on video games of their choice. Data is collected through an anonymous survey distributed to all learners who completed the course and semi-structured interviews with a selected group of participants. Learners' project reports are also examined as individual cases to provide further insights into their learning experiences and outcomes. Learners' self-perceived learning experiences are analyzed to establish which aspects of the course most effectively support learning and professional readiness. By examining learners' experiences within an existing Games User Research course, this work provides evidence-informed recommendations for curriculum design and the teaching of Games User Research in higher education. It is suggested that authentic, active learning should be implemented through the application of industry proven games user research instruments to real life scenarios involving representative samples of gamers across major publisher-backed blockbusters as well as indie games.

Keywords: *Games User Research, Game Studies, Game Design, User Experience, Higher Education.*

11. Perceptions of Esports, Transferable Skills, and Employability in Sub-Saharan Africa

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Abstract

Despite global growth, evidence on esports in Sub-Saharan African higher education remains limited. This study examines perceptions of esports, transferable skills, and employability amongst students, graduates, and educators. An exploratory mixed-methods design combined an anonymous online survey with 11 semi-structured interviews conducted in June and July 2026. Survey recruitment used convenience and snowball sampling through university groups, Discord servers, higher education contacts, and student networks. At the 24 July cut-off, 130 adult responses remained after excluding six respondents aged 12--18. Respondents represented Rwanda (n=52), Nigeria (n=28), South Africa (n=26), Uganda (n=18), Togo (n=2), Kenya, Namibia, Côte d'Ivoire, and South Sudan (n=1 each). Interviews involved South African students, graduates, and educators, including three participants from one secondary-school esports case. Survey data were analysed descriptively and transcripts thematically. Survey submission indicated informed consent; interview data were de-identified following written consent. Most respondents (90.0%) believed gaming and esports develop skills useful beyond play. Strategic thinking (88.5%), problem solving (86.2%), teamwork (79.2%), and communication (72.3%) were most frequently identified. Agreement that esports supports personal development and learning was high (M=4.14, SD=0.95; median=4/5). Although 71.5% believed esports could support employability, only 46.2% believed employers recognise esports-related skills. Leading barriers were equipment costs (71.5%), internet connectivity (68.5%), limited facilities (64.6%), and funding (63.8%). Interview themes showed a consistent gap between perceived skill development and access to recognised educational or career pathways, alongside weak institutional visibility and unequal infrastructure. Esports is widely perceived as a setting for transferable skill development, but its employability potential is constrained by limited recognition, infrastructure, and structured pathways. Higher education institutions should connect esports activities more explicitly to curriculum, career guidance, and industry partnerships.

Keywords: *esports, higher education, transferable skills, employability, Sub-Saharan Africa*

Poster Presentations

1. Integrating Gamified Frameworks to Enhance Student Problem-Solving and Collaboration in Mathematics and English Subjects in Rwanda Secondary Schools

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Abstract

The current landscape of educational gamification in secondary schools is still at the emerging stage but being tested as Rwanda education is transitioning from basic content toward active, interactive and gamified models. Even though the Competence Based Curriculum (CBC) promotes active, competence-based learning, the results from the Learning Achievement in Rwandan Schools (LARS), 2025 reveals that secondary school students in Rwanda still face real challenges in mathematics and English. However, little research has focused on how educational gamification, adapted to the Rwandan context, could help solve these problems. This study will present the educational gamification as the integration of game-based learning activities into instructional practice. It will evaluate the impact of integrating educational gamification specifically on academic performance, transferable cognitive skills, problem solving and collaboration ability in learning Mathematics and English equally among lower secondary school students. Using a mixed-methods quasi-experimental pilot design over a 3-month intervention, the research targets a sample of N = 100 S1 students and 4 subject teachers in 2 selected secondary schools in Gicumbi district, purposely selected to represent a variation in rural and urban location. Participants will be divided into a control group receiving standard CBC instruction ($n = 30$) and an intervention group utilizing localized gamified tools ($n = 30$). Quantitative pre- and post-tests measuring achievement gains and problem-solving speed will be analyzed using paired t-tests and Analysis of Variance (ANOVA), while qualitative data from surveys, semi-structured interviews, and student reflective essays will assess motivation, peer collaboration, and implementation feasibility in low-bandwidth settings. Findings are expected to demonstrate that educational gamification can contribute to improved academic achievement, motivation, self-confidence and collaborative learning. Ultimately, this project aims to propose a practical and evidence-based roadmap for scaling educational gamification in secondary schools in Rwanda with sustainable digital pedagogy and for strengthening lifelong workforce readiness in Rwandan secondary education.

Keywords: *Competence-Based Curriculum (CBC), Digital Pedagogy, Educational Gamification, Transferable Skills*

2. Strengthening Lifelong Learning in TVET for Sustainable Livelihoods and Food Security: A Textile and Apparel Value Chain Approach

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Abstract

Achieving Sustainable Development Goal 2 (SDG 2: Zero Hunger) requires not only enough food but also livelihoods, employment and income that help households meet their food and basic needs. Technical and Vocational Education and Training (TVET) can contribute indirectly to this goal by developing lifelong learning skills that help graduates find employment, start businesses, adapt to workplace changes and take part in value chains. However, limited evidence exists on how these skills are developed in textile and apparel TVET programmes and how they support livelihoods and household food security. This study examines lifelong learning competencies, including critical thinking, problem-solving, creativity, digital literacy, entrepreneurship and self-directed learning, in textile and apparel TVET programmes. It explores how these competencies can improve employability, entrepreneurship and participation in design, sourcing, production, manufacturing and marketing. A mixed-methods research design will be used, involving TVET learners, educators and industry stakeholders from institutions. Data will be collected through structured questionnaires and semi-structured interviews. Quantitative data will be analysed using descriptive statistics, while qualitative data will be analysed thematically. The study will also examine how learner-centred teaching, work-integrated learning, industry partnerships and digital technologies can strengthen lifelong learning skills. The study proposes a pathway from TVET skills to SDG 2, lifelong learning competencies can improve employability and entrepreneurship; these can increase access to employment, self-employment and business opportunities; improved opportunities can increase household income; and higher household income can strengthen livelihoods and improve the ability to access sufficient food. The study therefore views textile and apparel TVET as an indirect pathway to SDG 2 through skills development, employment, entrepreneurship, income generation, sustainable livelihoods and household food security. The expected outcome is a framework for strengthening lifelong learning in TVET textile and apparel programmes. The findings are expected to support curriculum development, policy and industry partnerships that promote sustainable livelihoods and contribute to SDG 2.

Keywords: *Technical and Vocational Education and Training (TVET), Lifelong Learning Competencies, Sustainable Textile and Apparel Value Chains, SDG 2 (Zero Hunger), Skills Development, Entrepreneurship.*

3. Scaffolding English Language Usage in Rwandan Business Taxation: A Sociolinguistic Perspective

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Abstract

This study investigates the role of English language usage in Rwandan business taxation from a sociolinguistic perspective, with particular attention to how language can be scaffolded to support taxpayers' understanding and participation in tax administration. It is guided by four specific objectives, namely: (i) to identify English language barriers encountered by business taxpayers in Rwanda's tax administration; (ii) to examine how business taxpayers interpret specialised English tax terminology; (iii) to analyse communication and meaning negotiation between taxpayers and tax officers; and (iv) to develop language-sensitive approaches for improving institutional tax communication, taxpayer education, and access to digital tax services. The study adopts a qualitative design informed by Constructivist Grounded Theory to facilitate an in-depth understanding of taxpayers' experiences with institutional tax communication. Data are generated through document analysis, semi-structured interviews, and focus-group discussions involving SME taxpayers, big business owners, certified tax consultants, and Rwanda Revenue Authority tax officers from Kigali city, Rusizi and Rubavu district. The analysis draws on Interactional Sociolinguistics, Systemic Functional Linguistics and Critical Discourse Analysis, with particular attention to linguistic accessibility, semantic interpretation, multilingual communication, clarification, paraphrasing, conversational repair, and institutional discourse. As the research is still in progress. However, the study is expected to demonstrate how complex English tax terminology, differences in semantic interpretation, multilingual communication challenges, and interactional barriers may affect taxpayers' engagement with institutional tax communication. It further seeks to show how linguistic scaffolding through simplified terminology, contextual explanations, bilingual or multilingual support, and accessible digital communication can facilitate taxpayers' understanding and interaction with tax services. The study highlights the role of language-sensitive taxpayer education and accessible digital communication in supporting lifelong learning and engagement with Rwanda's digital tax services.

Keywords: *English language usage; language scaffolding; taxpayer education; digital literacy; sociolinguistics, lifelong learning.*

4. Examining the current status and challenges of rehabilitation services in inclusive primary schools in Rwanda

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Abstract

Inclusive education requires interdisciplinary rehabilitation services to ensure equitable access, meaningful participation, and improved learning outcomes for learners with disabilities. However, evidence on the provision of rehabilitation services within Rwandan inclusive primary schools remains limited. This study assessed the availability, accessibility, and delivery of rehabilitation services in Rwandan inclusive schools using a convergent parallel mixed methods design. Quantitative data were collected from 75 learners with disabilities across five inclusive primary schools, with one school purposively selected from each of Rwanda's four provinces and Kigali City to ensure geographical representation. Qualitative data were obtained through interviews with five head teachers and focus group discussions with the teachers and rehabilitation professionals. Quantitative and qualitative findings were merged to generate comprehensive findings about service provision. The results revealed considerable disparities in the provision of rehabilitation services across participating schools. Physiotherapy services were available in two schools, occupational therapy and prosthetics and orthotics in one school, while no school provided speech therapy services. Two schools offered no rehabilitation services, and available services were delivered through a pull-out model. Transportation was the most frequently reported barrier, followed by financial constraints, limited social support, and inadequate information. Learners in schools with limited or no rehabilitation services experienced significantly greater financial and transportation barriers. The findings indicate that the challenges extend beyond service availability to fragmented and weakly integrated rehabilitation within inclusive education systems. The study proposes a school-linked interdisciplinary rehabilitation approach in which schools serve as coordination points for assessment, referral, intervention, and follow-up in collaboration with the health sector. Policy and practice should establish formal school-rehabilitation referral pathways, multidisciplinary outreach, teacher capacity building, and financing mechanisms to reduce access barriers. This approach could strengthen continuity of care, participation, and educational outcomes while providing a framework for integrating rehabilitation services into Rwanda's inclusive education system.

Keywords: *Rehabilitation services, inclusive education, learners with disabilities, school-based rehabilitation, access to services*

Theme VI. Transformative Higher Education and Institutional Change

Oral Presentations

1. Redesigning a Face-to-Face Course for Self-Paced Online Learning: An Instructional Design Case Study

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Abstract

Higher education institutions are increasingly redesigning traditionally campus-based courses to provide greater flexibility through online and self-paced study delivery models. Learning outcomes, assessments, and learning activities that were previously mediated through instructor presence must therefore be explicitly represented within the online environment (Müller & Mildenberger, 2021). This study presents a pre-implementation instructional design case study of the redesign process for a course within an undergraduate business programme at the University of Agder. The introductory HR course was transformed from a face-to-face teaching into a self-paced online format. ADDIE structured the instructional design and development process while backward design guided curriculum alignment (Branch, 2009; Wiggins, 2009). Data informing design decisions included consultations with the Subject Matter Expert (SME), curriculum benchmarking, and iterative design workshops. Formative evaluation, including SME review, curriculum mapping, quality assurance, accessibility, and usability checks, confirmed constructive alignment and identified areas for refinement in course content, navigation, and learner support features. Summative evaluation of learner experiences and outcomes will be conducted during subsequent implementation phases. Ethical considerations included voluntary participation of contributors, confidentiality of feedback, and adherence to institutional research ethics principles. This study reports on the Analysis, Design, and Development phases of the ADDIE process prior to implementation. Insights from the design process suggest that the combination of curriculum mapping, backward design, and ADDIE supported alignment and traceability throughout the redesign process. Collaboration between subject matter experts and instructional designers appears to play a central role in translating disciplinary expertise into coherent learning outcomes, assessments, and learning activities. These findings may inform instructional designers, curriculum developers, and higher education institutions seeking to redesign programmes for evolving labour market and lifelong learning needs.

Keywords: *Instructional design; curriculum alignment; online learning; backward design; ADDIE*

2. Assessing the Translation Quality of Government Documents from English into Kinyarwanda in the Digital Era: Evidence from Imihigo Performance Contracts in Nyamagabe District

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Abstract

Accurate translation of government documents is essential for effective public communication, transparency, accountability, and meaningful citizen participation in multilingual contexts such as Rwanda. Imihigo performance contracts are important governance instruments for planning, monitoring, and evaluating public sector performance and are increasingly disseminated through digital platforms. However, mistranslation, literal rendering, inconsistent terminology, and semantic loss may compromise the meaning and communicative effectiveness of English--Kinyarwanda translations. Despite the strategic importance of Imihigo, limited empirical research has examined the quality of their translations and their implications for policy information transfer. This study assesses the translation quality of selected Imihigo performance contracts in Nyamagabe District. Guided by House's Translation Quality Assessment Model, Nida's Theory of Functional Equivalence, and Skopos Theory, it investigates the extent to which translated texts preserve semantic accuracy, functional equivalence, and communicative purpose. Using a qualitative case study design, the research combines documentary analysis with semi-structured interviews involving translators and district officials. Thematic analysis will identify recurring translation challenges, evaluate current translation practices, and explore how digital innovations, including computer-assisted translation tools, terminology management systems, and AI-assisted translation, could improve consistency, efficiency, and accuracy. The study is expected to provide evidence-based recommendations for translators, policymakers, and public institutions, strengthen multilingual government communication, and improve citizens' access to policy information. Ultimately, it demonstrates how high-quality, accessible translation can support informed participation, transparent local governance, effective public administration, and inclusive sustainable development in Rwanda

Keywords: *Translation Quality Assessment; Multilingual Dissemination; Government Document Translation; Digital Translation Tools; Imihigo Performance Contracts; Kinyarwanda; Public Communication; Rwanda.*

3. Digital Transformation in Higher Education Institutions: A Systematic Literature Review of Drivers, Challenges, and Institutional Readiness

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Abstract

Digital transformation is reshaping higher education, but universities differ considerably in their capacity to convert technological investment into sustained institutional change. This systematic literature review examined the principal drivers, persistent challenges, and dimensions of institutional readiness associated with digital transformation in higher education institutions. The review considered peer-reviewed literature published from 2021 to 2026 and followed the PRISMA 2020 reporting framework. Searches were conducted across Scopus, Web of Science, ERIC, ScienceDirect, SpringerLink, Taylor & Francis Online, Wiley Online Library, IEEE Xplore, Emerald Insight, SAGE Journals, and Google Scholar, supplemented by reference-list searching. The search produced 1,280 records, comprising 1,248 database records and 32 additional records identified through reference lists. After 287 duplicates were removed, 993 records underwent title and abstract screening. Of these, 853 were excluded, leaving 140 full-text articles for eligibility assessment. A further 120 articles were excluded at the full-text stage, resulting in 20 articles in the final synthesis. Eligibility was determined using predefined criteria concerning publication period, peer-reviewed status, higher education focus, language, accessibility, and substantive relevance to institutional digital transformation. The selected evidence was quality-appraised and thematically synthesized through coding, categorization, comparison, and development of higher-order themes. Three interconnected areas emerged: institutional drivers, implementation challenges, and institutional readiness. Leadership, strategic vision, digital infrastructure, digital competencies, organizational culture, governance, and supportive policy environments were recurring enablers, whereas financial limitations, infrastructure gaps, resistance to change, cybersecurity concerns, and unequal digital access remained important constraints. The review suggests that institutional readiness is better understood as a dynamic organizational capability than as technological preparedness alone.

Keywords: *digital transformation; higher education institutions; institutional readiness; digital leadership; digital governance; systematic literature review; organizational change.*

4. Enhancing Students' Mathematics Problem-Solving Skills through Low-Tech Learner-Centered Strategies: Evidence from Selected Lower Secondary Schools in Rutsiro District, Rwanda

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Abstract

Transformative education emphasizes innovative, equitable, and learner-centered approaches responding to educational contexts (UNESCO, 2021). While digital innovation transforms education, unequal access to technology requires sustainable innovations beyond advanced technologies (UNESCO, 2023). Low-tech learner-centered strategies represent such innovations by promoting active learning in resource-constrained settings. This study investigated improvements in students' mathematics problem-solving skills following the implementation of these strategies. The study employed an explanatory sequential mixed-methods design guided by a pragmatic paradigm. A quasi-experimental pre-test-post-test design was conducted with 88 Senior One students from two selected lower secondary schools in Rutsiro District, Rwanda. The sample included an experimental group (n = 49) and a control group (n = 39). The intervention integrated group work, peer teaching, manipulatives, guided discussions, and real-life problem-solving activities. Quantitative data were analyzed using paired-samples *t*-tests, Mixed ANOVA, and ANCOVA, while qualitative data from observations and interviews were analyzed thematically. Both groups improved after the intervention; however, the experimental group demonstrated greater gains. Students exposed to low-tech learner-centered strategies improved by 9.88 points compared with 1.63 points in the control group. Mixed ANOVA revealed a significant Time × Group interaction, while ANCOVA confirmed an intervention effect after controlling for pre-test differences. Qualitative findings indicated increased student engagement, collaboration, confidence, and participation. The findings demonstrate that transformative mathematics education does not solely depend on advanced technologies. Low-tech learner-centered strategies provide sustainable approaches for strengthening problem-solving skills and supporting equitable curriculum implementation. These approaches can be adapted in resource-constrained schools across Rwanda and similar contexts to advance transformative education.

Keywords: *Low-tech strategies; learner-centered strategies; mathematics problem-solving skills; competency-based curriculum; resource-constrained contexts*

5. Developing an AI Chatbot for Student Inquiry Handling for Higher Education Institutions in Uganda

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Abstract

Student inquiry handling is a critical administrative support function in higher education institutions, particularly during admissions, course registration, tuition payment, examinations, release of results, transcript processing, and graduation. In many Ugandan higher education institutions, these inquiries are managed through physical office visits, telephone calls, emails, and institutional websites, resulting in delayed responses, inconsistent information, repetitive administrative work, and reduced service efficiency. Generative Artificial Intelligence (GenAI), particularly large language model (LLM)-enabled chatbots, presents an opportunity to automate routine and information-intensive inquiries while improving the accessibility, consistency, and timeliness of institutional support services. Guided by Task-Technology Fit (TTF) theory, this study identified common student inquiry tasks and assessed their compatibility with Generative AI capabilities. Routine, repetitive, and rule-based inquiries including: admissions, registration, tuition payment, academic calendars, examination information, transcript requests, and graduation requirements were found to exhibit a strong task technology fit and were therefore assigned to the chatbot, whereas complex, policy-sensitive, and judgement-based inquiries were designed to be escalated to university administrators. Design Science Research (DSR) guided the requirements elicitation through twenty stakeholder interviews, followed by the design, development, and evaluation of the Generative AI chatbot. The artifact was evaluated using response accuracy, response time, response consistency, usability, and user satisfaction. The findings demonstrate that aligning Generative AI capabilities with appropriate student inquiry tasks improves access to institutional information, reduces repetitive administrative workload, and enhances the responsiveness and consistency of student support services. This study contributes an AI chatbot artifact and demonstrates how integrating Task-Technology Fit theory with Design Science Research supports the responsible adoption of AI-enabled administrative services in higher education institutions.

Keywords: *Generative Artificial Intelligence; AI chatbot; student inquiry handling; higher education*

6. Assessing Institutional Effectiveness and Strategic Priorities: A Case of the School of Educational Sciences at the University of Rwanda-College of Education

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Abstract

Higher education institutions are expected to demonstrate excellence in teaching, research, leadership and strategic planning while responding to evolving societal and educational needs. This study assessed teaching, research, leadership, and strategic priorities for institutional development in the School of Educational Sciences at the University of Rwanda-College of Education. Despite strengths in teamwork, learner-centered pedagogies and structured professional activities, the school faces persistent challenges that limit its effectiveness to achieve those ambitions. The study adopted a mixed-methods design, collecting quantitative and qualitative data from academic staff through structured questionnaires. Quantitative data were analyzed using descriptive statistics, while qualitative responses were thematically examined to identify institutional strengths, gaps and priorities. Findings revealed modest research productivity, with achievements in partnerships and research cluster formation, but constrained by heavy teaching loads, reported by nearly 60% of respondents, insufficient funding and weak mentorship. Leadership and governance were characterized by clear structures and collaboration, although gaps remained in workload management, communication and support systems. Over 70% of staff identified overcrowded classrooms as a major barrier, while more than half rated research support as poor (scores of 1-2 on a 5-point scale). These constraints undermine teaching quality, research productivity, and effective governance, limiting the school's ambition to become a leading center of Educational Sciences. The study recommends institutional leadership to prioritize staff recruitment, equitable workload distribution, infrastructure investment, academic staff to build stronger collaborative research clusters, continuous professional development, policy makers and partners to expand funding opportunities, international collaborations and support for long-term institutional development initiatives.

Keywords: *institutional effectiveness; higher education; teaching quality; research productivity; leadership and governance; strategic planning*

7. Redesigning hospitality curricula for future jobs: Aligning pedagogical approaches with oral French communication at Rwanda Polytechnic

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Abstract

The global hospitality sector requires graduates with strong foreign language skills and intercultural competence. This is happening despite a growing demand for multilingual professionals in Rwanda. Furthermore, little empirical research shows how actual classroom teaching methods influence the French-speaking skills of technical college students in Rwanda. To address this knowledge gap, this study evaluated how different teaching approaches affect students' oral French communication skills. It also calls attention to the need for technical colleges to redesign their study programs to better prepare graduates for long-term employment. The research investigation was guided by socio-constructivist theory and the action-oriented learning approach. The Common European Framework of Reference for Languages was also drawn upon. The research used a mixed-methods sequential explanatory design where survey data were gathered from 110 hospitality students across Rwanda Polytechnic colleges. Qualitative data from interviews with six French lecturers and classroom observations were used to explain the statistical results. On the other hand, quantitative data were analyzed through descriptive measures and Pearson's correlation tests. The findings showed a gap between educational policies and daily teaching practices. They revealed that teachers rarely use communicative activities, though they understood their effectiveness. Against this background, the study found a strong positive correlation between interactive teaching methods and oral speaking ability ($r=.653$, $p<.001$). The result proves that active learning, real-world practice, and task-based activities significantly improve professional French communication. This study connects classroom teaching directly to oral French skills in vocational higher education. It shows that institutions must reform teaching practices to bridge the gap between curriculum goals and real classroom learning. It therefore recommends updating hospitality training by integrating authentic work tasks, collaborative learning, and interactive practice, as well as incorporating digital for directly supporting the curriculum innovation. All the above aspects will build the transferable skills needed for modern jobs and capacity-building goals championed by the TELLS partnership.

Keywords: *Hospitality Education, Curriculum Redesign, Oral French Communication Transferable Skills, Competency-Based Education, Rwanda Polytechnic*

8. Evidence-Based Interventions and Gender-Responsive Educational Leadership for Strengthening Girls' STEM Participation in Rwanda

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Abstract

Despite increasing investment in gender-responsive interventions, limited empirical evidence explains how evidence-based interventions interact with educational leadership and school--community contexts to influence girls' participation in Science, Technology, Engineering, and Mathematics (STEM) education. This study examined how these interconnected conditions shape girls' participation in STEM in secondary schools in Nyagatare District, Rwanda. Guided by a pragmatic paradigm, the study employed a sequential explanatory mixed-methods design. Quantitative data from 431 students and teachers were analysed to identify statistical relationships among intervention factors, educational experiences, and STEM participation, followed by qualitative inquiry through focus-group discussions and 34 key informant interviews to explain underlying mechanisms across school and community contexts. The findings showed that mentorship, career guidance, and gender-responsive pedagogy were the intervention domains most strongly associated with girls' STEM participation, confidence, and STEM identity development. Regression analysis demonstrated that school--community ecosystem factors significantly predicted STEM participation ($F(5,425) = 2.675$, $p = .022$), with career guidance showing the strongest contribution. Qualitative findings further revealed that these interventions were most effective when supported by gender-responsive leadership, institutional coherence, family engagement, and positive community expectations. Rather than functioning as isolated initiatives, evidence-based interventions operated as interconnected mechanisms that challenged gender stereotypes, strengthened learners' confidence, and expanded girls' perceived STEM pathways. The study develops the Gender-Transformative Educational Leadership Framework (GTELF) as an empirically derived framework that explains how evidence-based interventions, educational leadership, and school--community partnerships interact to strengthen girls' participation in STEM. The findings contribute to transformative educational leadership and institutional change by demonstrating how universities, schools, and communities can collaborate to develop sustainable gender-responsive practices, strengthen leadership capacity, and create inclusive STEM pathways in Rwanda and comparable contexts.

Keywords: *STEM education; evidence-based interventions; gender-responsive educational leadership; school--community partnerships; STEM identity; Rwanda.*

9. The use of Finite Element Analysis (FEA) as a teaching tool to improve learning of engineering students in Rwanda

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Abstract

Engineering education, particularly Mechanical Engineering, relies heavily on laboratory-based learning to bridge theoretical concepts and practical applications. However, many higher education institutions in Rwanda face significant challenges in providing adequate laboratory experiences due to the high costs of acquiring, operating, and maintaining engineering laboratory equipment. Consequently, students often have limited opportunities to perform experiments that reinforce classroom learning and develop analytical and problem-solving skills. Finite Element Analysis (FEA) offers a cost-effective solution by enabling virtual laboratories that simulate real engineering phenomena. This study investigated the use of FEA-based virtual laboratories as a teaching tool for undergraduate Mechanical Engineering courses. ANSYS was integrated into selected courses, including Strength of Materials, Heat Transfer, Materials Science, and Fluid Mechanics. The virtual laboratories complemented conventional laboratory instruction by enabling students to visualize stress distribution, structural deformation, heat transfer, fluid flow, and other engineering phenomena. Students conducted virtual experiments, modified design parameters, analyzed simulation results, and applied engineering principles to practical engineering problems. A mixed-methods approach involving classroom implementation, student assessments, surveys, and instructor feedback was used to evaluate the effectiveness of the approach. The findings showed that integrating FEA significantly improved students' conceptual understanding, practical competence, engagement, and confidence in solving engineering problems. Students reported that numerical simulations strengthened their ability to connect theoretical concepts with real-world engineering applications, while instructors observed greater classroom participation and deeper discussions. The study concludes that FEA-based virtual laboratories effectively complement conventional laboratory teaching and provide a practical, cost-effective strategy for enhancing the quality, accessibility, and sustainability of engineering education while equipping graduates with industry-relevant digital engineering skills.

Keywords: *Finite element analysis, mechanical engineering, Conventional laboratories*

10. Reciprocal-Centric Pedagogy for Competence-Based Higher Education: Nurturing a Theory-Building Framework for Teaching, Learning and Knowledge Construction in Ugandan Universities

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Abstract

The shift toward Competence-Based Higher Education (CBHE) in Uganda necessitates reconsideration of the University pedagogy. It requires renewed attention to the foundations of teaching, learning, and knowledge construction. While the competence philosophy emphasizes the development and demonstration of integrated graduate capabilities, its enactment requires pedagogical approaches that move beyond transmission-oriented assumptions. In practice, this demands the creation of relational, participatory, and knowledge-generating learning environments. Despite growing policy attention to CBHE in Ugandan universities, its pedagogical dynamics remain untheorized. Limited attention has been given to how classroom interactions foster learner agency, knowledge co-construction, and graduate capacity development. Expanding upon the earlier conceptualization of Reciprocal-Centric Pedagogy (RCP) as an ontological reorientation of power and epistemic relations within universities, this paper develops and advances RCP as a theory-building framework for CBHE in Uganda. The analysis generates theoretical propositions linking reciprocity with learner agency, knowledge co-construction, professional identity formation, and graduate proficiency development. The framework conceptualises reciprocity as the central mechanism through which learner agency, collaborative knowledge construction, professional identity formation, and capability development occur. Unlike existing learner-centred approaches that primarily emphasise participation, RCP positions reciprocity as an ontological and epistemic foundation that reconfigures relationships of power, knowledge, and engagement within higher education. It argues that effective CBHE requires more than curriculum reform; it requires transformation of the relational processes through which knowledge, identity, and professional capability are constructed. RCP provides a contextually grounded theoretical framework for transforming university teaching and learning through reciprocal engagement, learner agency, and knowledge co-construction. The framework contributes to life-long learning and transformative approaches to CBHE in Uganda, while extending international scholarship on CBHE. It provides a theoretical basis for designing, implementing, and evaluating pedagogical relationships that nurture learner agency, knowledge co-construction, and graduate capability development.

Keywords: *Competence-Based Higher Education; Reciprocal-Centric Pedagogy; pedagogical relationships; learner agency; knowledge co-construction; graduate capability; professional identity.*

11. Teaching What We Were Never Taught: Teacher-Educators and Transferable Skills in Rwanda

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Abstract

Rwanda's 2016 competency-based curriculum (CBC) prioritises transferable skills, namely critical thinking, creativity, collaboration, and problem-solving, to foster lifelong learning and labour market readiness. Teacher-educators are tasked with modelling these competencies, yet they were themselves formed under a content-saturated, examination-driven system. This creates a core paradox of being expected to teach what they were never taught. Despite curriculum reforms, little is known about how teacher-educators experience and enact these new expectations. This study explores how six teacher-educators at a Rwandan Teacher Training College understand, experience, and enact transferable skills within the CBC. Employing Interpretative Phenomenological Analysis, data were gathered through in-depth, semi-structured interviews. Idiographic analysis preceded cross-case comparison. Themes were developed through iterative coding, and trustworthiness was ensured through member checking and peer debriefing. Findings reveal strong commitment to the CBC vision alongside profound tension regarding pedagogical readiness. Three major themes emerged: identity transition from knowledge-transmitter to facilitator, and the implicit modelling dilemma, where unconscious practices go unrecognised by pre-service teachers. A third theme, professional uncertainty, stemmed from insufficient professional development. Overcrowded classrooms and material shortages further constrain innovation. Digital tools were seen as potential pathways to creativity and collaboration. However, participants reported limited access and training, revealing a critical gap in digitally-supported pedagogy. Translating lifelong learning policy into sustainable classroom reality depends on reconceptualising teacher-educator identity, and on embedding digital innovation within Continuous Professional Development. This research contributes to sustainable development in education by demonstrating that CBC success hinges on teacher-educators' professional agency. Recommendations include CPD redesign, reflective mentoring circles, and integration of digital pedagogical tools, with relevance for TELLS-supported teacher education initiatives in the Global South.

Keywords: *Transferable skills, lifelong learning, teacher-educators, Interpretative Phenomenological Analysis, Rwanda*

12. Enhancing Secondary Students' Conceptual Understanding of Electrochemistry through Discovery-Based Practicals Using Improvised Materials in Rutsiro District, Rwanda

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Abstract

Electrochemistry remains a challenging area of secondary school chemistry because many concepts are abstract and difficult to understand through conventional classroom explanations alone. This challenge is particularly pronounced in resource-constrained schools, where limited laboratory facilities restrict students' opportunities for practical engagement. This study investigated the contribution of discovery-based practicals using improvised materials to students' conceptual understanding of electrochemistry in selected secondary schools in Rutsiro District, Rwanda. A mixed-methods approach was employed using a quasi-experimental pre-test--post-test design involving 120 students, equally divided into experimental and control groups. Quantitative data were collected through pre-tests, post-tests, and student questionnaires, while qualitative data were obtained through teacher interviews and focus group discussions. Quantitative data were analyzed using descriptive statistics, paired- and independent-samples t-tests, Cohen's *d*, and Hake's normalized gain, while qualitative data were analyzed thematically. The groups were comparable before the intervention, with no significant difference in pre-test performance ($p = .3195$). Following the intervention, the experimental group achieved significantly higher post-test scores than the control group, $t(118) = -4.53$, $p < .001$, with a large effect size (Cohen's $d = 0.83$). Hake's normalized gain was also higher for the experimental group (0.190) than for the control group (0.052). Students reported increased interest, active participation, and improved understanding of electrochemistry, while qualitative findings indicated greater learner independence, collaboration, and engagement with practical phenomena. However, inadequate teacher preparation, limited laboratory equipment, insufficient time, and large class sizes constrained implementation. The findings suggest that integrating discovery-oriented practical activities with locally available materials can strengthen students' conceptual understanding of electrochemistry and provide a context-responsive approach to chemistry teaching in resource-constrained secondary schools.

Keywords: *Conceptual understanding; Discovery-based practicals; Electrochemistry; Improvised materials; Secondary education*

13. Transforming Teacher Training Colleges in Rwanda: Institutional Pathways for Competence-Based Teacher Certification

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Abstract

This study examines the transformation of Teacher Training Colleges (TTCs) in Rwanda through the introduction of a five-year Diploma pathway announced by the Ministry of Education for the 2026/27 academic year, designed to strengthen teacher professionalization, institutional quality assurance, and lifelong learning within the Competence-Based Curriculum. Using qualitative policy analysis and a case study approach, the research draws on institutional documents, curriculum frameworks, and teacher perspectives, guided by socio-cultural theory and transformative learning theory. Findings indicate that the reformed Diploma framework enhances teacher preparedness and classroom effectiveness through strengthened content preparation, an extended year of supervised teaching practice, and examinations certified by the University of Rwanda. Complementary policy measures --- including increased capitation grants, revised parental contributions, stricter discipline enforcement, and adjusted school schedules --- further situate the reform within broader institutional change. The reform integrates socio-emotional competences, digital innovation, and lifelong learning principles, while drawing on culturally grounded values such as Ubuntu, Ubudehe, and Umuganda to connect professional learning with Rwanda's social and cultural context. The study concludes that Rwanda's TTC Diploma pathway provides a promising institutional model for integrating professionalization, quality assurance, competence development, and sustainable professional growth in teacher education, with implications for policymakers, teacher educators, and researchers seeking to advance transformative higher education, inclusive development, and sustainable learning systems in Rwanda and the wider sub-Saharan African context.

Keywords: *Transformative higher education; institutional change; Teacher Training Colleges; certificate in education; digital innovation; lifelong learning; Rwanda*

Poster Presentations

1. Designing a Collaborative Learning Resource Infrastructure for Co-Creation and Sharing in Higher Education

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Abstract

The rapid digital transformation of higher education has accelerated the creation of digital learning resources; however, collaborative practices for developing, co-creating, sharing, and sustaining these resources remain fragmented across Learning Management Systems (LMSs), cloud platforms, and institutional repositories. Existing approaches primarily facilitate storage and distribution while providing limited support for interoperability, governance, quality assurance, and sustainable collaboration across institutional boundaries. This study addresses these challenges by designing a collaborative learning resource infrastructure that supports the co-creation and sharing of digital learning resources in higher education. This study adopted Design Science Research Methodology to design, develop, and evaluate OpenShare, a collaborative learning resource infrastructure for higher education. Guided by Activity Theory, Open Education Theory, Community of Practice, the study applied a Human-Centered Design approach to ensure the infrastructure addressed stakeholder needs. Data were collected through literature analysis, surveys, interviews, prototype evaluation and usability testing involving four universities participating in the Transformative Education and Lifelong Learning for Sustainable Growth project. Findings revealed fragmented resource sharing, limited interoperability, inconsistent governance, inadequate licensing, and absent collaborative workflows, informing OpenShare's iterative design. Evaluation with 12 participants found OpenShare intuitive and valuable for resource discovery, co-creation, sharing, and use within existing LMS. Moderated usability testing and post-test interviews assessed task completion, navigation, workflow clarity, ease of access, and perceived usability. Challenges involving ownership, institutional review, and technical integration informed design refinements. OpenShare extends conventional repositories and LMSs through a federated collaboration layer integrating governance, licensing, attribution, review workflows, and version control while preserving institutional ownership without replacing the existing LMSs. This study presents the design and prototype of OpenShare, a collaborative learning resource infrastructure developed to address the challenges identified in this study related to interoperability, licensing, quality assurance, and collaborative resource development. The findings suggest that integrating these capabilities within existing LMS can better support the co-creation, discovery, sharing, and reuse of digital learning resources across institutional boundaries.

Keywords: *Collaborative learning resource infrastructure; Digital learning resources; Co-creation; Higher education; Design Science Research Methodology; Human- Centered Design; Learning Management System.*

2. Analysing School Leadership's Role in Fostering Gender-Sensitive Learning Environments in Marginalised Zimbabwean Secondary Schools

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Abstract

In many marginalised secondary schools, where patriarchal norms continue to influence daily school culture and practice, gender-sensitive learning settings are still rare despite many years of global policy commitment to gender equity in education. Although gender-sensitive teaching has received substantial scholarly attention, school leadership's culture in creating gender-responsive environments remains undertheorised, especially in sub-Saharan Africa inclusive of Zimbabwe (Bush & Glover, 2016; Oplatka, 2006). This study addresses that gap by examining how school administrators in two underprivileged rural secondary schools in Zimbabwe execute leadership in the service of gender-sensitive learning environments. Grounded in a qualitative, interpretivist case study design (Yin, 2018; Merriam, 2009), the researcher used semi-structured interviews and non-participant observations with eight purposively selected participants school heads, deputy heads, senior teachers and department heads to capture the disjuncture between leaders' stated intentions and their contextualised practices. Transformative Leadership Theory (Shields, 2010) provides the analytical lens for understanding how leaders can either challenge unfair practices and advance institutional equity or unintentionally reinforce existing inequalities through their decisions and conduct. The findings reveal that while school leaders occupy a pivotal position in creating a gender-responsive school culture (Bush & Oduro, 2006), their capacity to advance gender equity is severely limited by three interconnected factors: some have gendered presumptions, lack of capacity to advance gender equity due to lack of training (UNESCO, 2017), and resource limitations in several underprivileged schools further restrict their ability to effect change. The paper concludes with targeted recommendations for national policymakers, calling for mandatory gender-responsive leadership training, revised promotion criteria, ring-fenced infrastructure funding, and context-specific accountability mechanisms that render gender equity a measurable, non-negotiable dimension of school leadership in Zimbabwe.

Keywords: *school leadership; gender-sensitive learning environments; gender-responsive education; transformative leadership; marginalised schools*

3. Inclusive Education in Rwanda's Competence-Based Curriculum: Teachers' Experiences, Challenges and Opportunities for Educational Transformation

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Abstract

Rwanda has demonstrated a strong commitment to inclusive education through national policies and reforms designed to ensure equitable access to quality learning for all students, including learners with disabilities. The introduction of the Competence-Based Curriculum (CBC) has reinforced learner-centred teaching, competency development, and meaningful participation. However, implementation remains challenging. This study examines teachers' lived experiences of implementing inclusive education within Rwanda's CBC and identifies context-specific opportunities for educational transformation. Using a qualitative approach, data were collected through semi-structured interviews, focus group discussions, classroom observations, and document review in selected primary and secondary schools. Thematic analysis was used to identify teachers' experiences, implementation barriers, and promising practices. Findings indicate that teachers generally hold positive attitudes towards inclusive education and recognize its value in promoting equitable learning opportunities. Nevertheless, they reported inadequate training in inclusive pedagogies, limited teaching and learning resources, overcrowded classrooms, insufficient support services for learners with disabilities, and weak collaboration among education stakeholders. Teachers identified collaborative learning, peer-support mechanisms, school-based professional learning communities, and continuous professional development as practical strategies for strengthening inclusion. The study further highlights the need for stronger institutional support, increased investment in accessible resources and assistive technologies, and improved collaboration among schools, families, communities, policymakers, and development partners. It concludes that successful implementation requires moving beyond policy compliance towards inclusive school cultures, responsive learning environments, learner-centred pedagogy, and equitable participation. Sustainable inclusion therefore depends on continuous teacher support, institutional commitment, and equitable access to traditional and digital learning opportunities. The study offers evidence-based recommendations for advancing inclusive, equitable, and sustainable education in Rwanda.

Keywords: *inclusive education, competence-based curriculum, teachers' experiences, educational transformation, Rwanda*