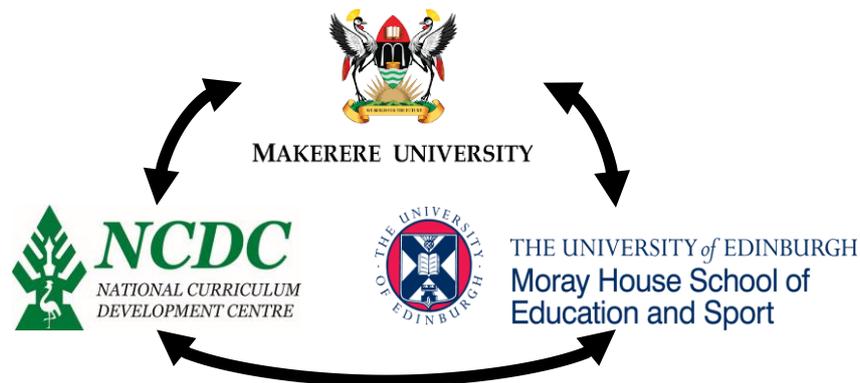# Generative AI for Accelerated Competency-Based Teacher Training in Crisis Contexts (GAI-ACT)

Funded by **code** | Promoting every child's right to read   **TLFC**   In partnership with **Canada**

Implementing Consortium (GAI4Educ):

MAKERERE UNIVERSITY

NCDC — NATIONAL CURRICULUM DEVELOPMENT CENTRE

THE UNIVERSITY of EDINBURGH — Moray House School of Education and Sport

Participating Institutions

MAKERERE UNIVERSITY · 1922-2022 · THE UNIVERSITY of EDINBURGH · MUNI UNIVERSITY · WAR child CANADA · NCDC NATIONAL CURRICULUM DEVELOPMENT CENTRE

Project Timeline: 17-Month Implementation Cycle

Contents

List of Figures

Acknowledgements

Target Audience & Beneficiaries:

According to the Original Proposal:

The primary target audience and direct beneficiaries were ICT teachers operating within fragile and crisis-affected contexts in Uganda. The project was specifically designed to target;

4 Cohorts of ICT teachers(aged 25 to 55 years)	20 refugee camps
34 refugee hosting schools	3 regions in Uganda

These educators were intended to act as Master Trainers within a cascading Trainer-of-Trainers (ToT) model at a 1:9 ratio, ultimately aiming to practically build the capacities of 612 teachers across 9 to 11 different subject areas. The core objective was to equip these frontline educators with the techno-pedagogical skills required to leverage Generative AI and prompt engineering for dynamic curriculum delivery. By enhancing the instructional capacities of these teachers, the project sought to directly improve education service delivery, classroom inclusivity, and learning outcomes for the ultimate downstream beneficiaries: highly vulnerable secondary-level learners, aged 16 to 45, enrolled in the Accelerated Education Programme (AEP) and mainstream schools in these marginalized communities.

Expanded Beneficiaries and Systemic Reach (Driven by Implementation Realities)

During the project's strategic implementation and co-creation phases, the scope of beneficiaries unexpectedly but necessarily expanded to include crucial institutional and higher education stakeholders. Initial focus group discussions revealed that high-level stakeholders, district officials, and regulators viewed AI as an abstract "buzzword" and rightfully required their own capacity to be built before they could safely authorize or regulate AI integration in fragile classrooms. Consequently, educational administrators and policy actors became unexpected primary beneficiaries, engaging with targeted governance tracks (such as GAI-ADM-101) to ensure institutional safeguarding, data privacy, and regulatory control were established first.

Furthermore, stakeholders highlighted a critical systemic gap: Teacher Training Institutions (TTIs) were not producing AI-ready educators, threatening to drastically exacerbate existing disparities between rural and urban schools, as well as mainstream and AEP environments. Responding to the recommendation to prioritize vulnerable regions, the consortium partnered with Muni University in Northern Uganda. When university lecturers exhibited initial resistance due to a lack of AI exposure, the project strategically pivoted to train them first. As a result, university administrators, lecturers, and non-teaching staff became direct beneficiaries, completing specialized Higher Education tracks (GAI-ED-001, 002, and 003).

Empowered by this capacity building, these university stakeholders transitioned from trainees into active co-designers, helping to develop the Open Educational Resource (OER) courses. By treating all participants across the system as Trainers of Trainers (ToTs), the project successfully reached both in-service teachers already in fragile contexts and pre-service teachers still in training institutions, establishing a sustainable, locally anchored ecosystem for AI educational delivery.

Executive Summary

Purpose of the Report

This comprehensive narrative report presents a highly detailed synthesis of the 17-month implementation lifecycle of the Generative AI for Accelerated Competency-Based Teacher Training in Crisis Contexts (GAI-ACT) project. Originally conceived as a targeted intervention to equip four cohorts of ICT teachers—operating across 20 refugee camps and 34 schools in Uganda—with prompt engineering skills using existing global Large Language Models (LLMs) such as ChatGPT and Gemini, the project underwent a profound and necessary evolution.

In response to the complex realities of fragile educational environments, the initiative expanded far beyond its initial scope of standard teacher training. It matured into a complex, system-wide, and deeply decolonial capacity-building ecosystem. By prioritizing the structural, pedagogical, and psychosocial needs of educators who serve vulnerable secondary-level learners (aged 16 to 45) in Accelerated Education Programmes (AEP) and mainstream settings, the project redefined AI integration. It shifted the paradigm from passive technological consumption to active, sovereign knowledge creation, ultimately building a sustainable framework that empowers both grassroots educators and high-level institutional stakeholders to co-create their digital futures.

The Educative Core for EdTech Stakeholders

At its educative core, this report serves as a transparent and critical reflection for EdTech Stakeholders and global policymakers, demonstrating unequivocally that sustainable AI integration in fragile contexts cannot rely on the top-down deployment of foreign, Western-centric technologies. When early implementation phases met justifiable institutional resistance from stakeholders concerned about unregulated technology, and when foreign LLMs exhibited severe epistemic biases and hallucinations that erased local contexts, the consortium employed agile and responsive project management. Driven by a commitment to institutional safeguarding and epistemic justice, these operational hurdles were transformed into catalysts for profound educational innovation.

The project successfully pivoted to co-create specialized Open Educational Resources (OERs)—ranging from administrative governance tracks to specialized AEP and trauma-informed pedagogical guides—hosted on a newly developed, sovereign e-learning platform designed for continuous iteration and low-bandwidth accessibility. Ultimately, the project moved Uganda from a consumer of foreign AI to a producer of local technology by benchmarking and developing two sovereign, localized Generative AI prototypes specifically tailored for the Competency-Based Curriculum (CBC) and Accelerated Education Programming (AEP). This report illustrates how ethical boundary-setting, speculative epistemic auditing, and participatory co-design can generate scalable, culturally legitimate technological solutions that protect educational sovereignty in the Global South.

The Original GAI-ACT Focus: Background and Strategic Context

This section establishes the initial parameters and vision presented to CODE, outlining the specific educational and structural crises the project sought to address before evolving into its current systemic model.

The Educational Crisis in Uganda's Fragile Contexts

The AEP and CBC Intersection

Uganda currently hosts over 1.5 million refugees, making it the largest host country in sub-Saharan Africa. Due to the nature of displacement, a massive demographic of young people and adults have had their education severely interrupted. To provide a viable pathway back into formal schooling, the National Curriculum Development Centre (NCDC), in conjunction with partners like War Child Canada, established the Accelerated Education Programme (AEP). The AEP specifically targets secondary-level learners aged 16 to 45 years, condensing years of conventional schooling into a shortened timeframe to allow over-age, out-of-school, and refugee learners to catch up.

However, a profound operational friction exists at the intersection of AEP and Uganda's newly rolled-out Competency-Based Curriculum (CBC). The CBC demands a total paradigm shift away from rote memorization toward highly interactive, learner-centric, and practical skills-based instruction.

Figure 1. Gathering more Structural and Safe Guarding Feedback from AEP implementers (MEAL officers)
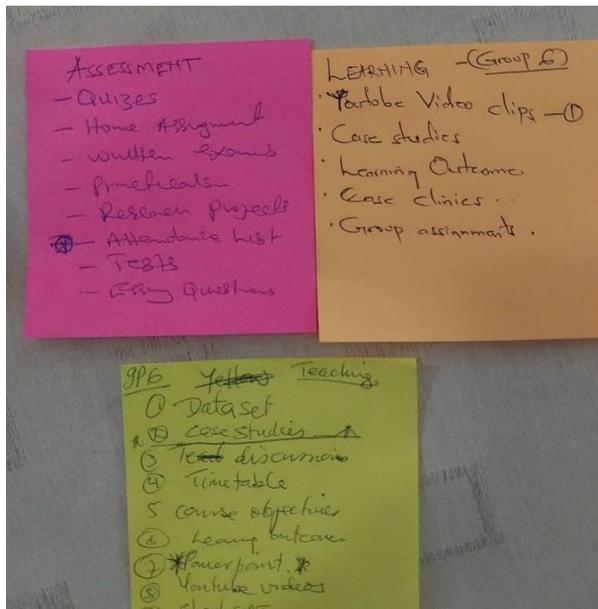
Figure 2. Notes of what GAI can do for the Teachers in AEP
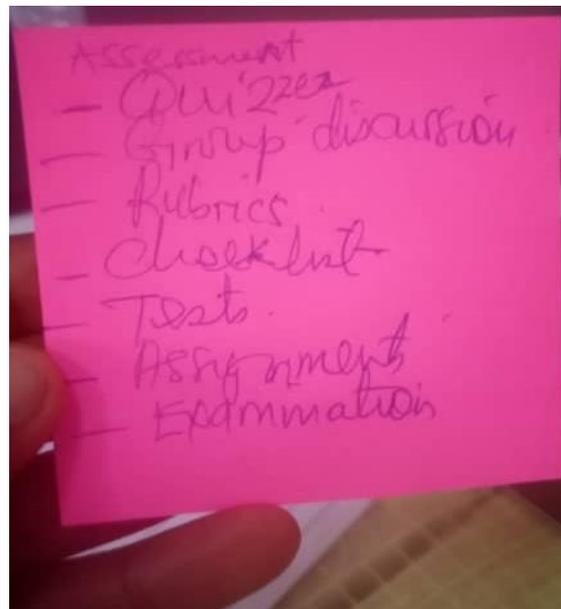
Figure 3. Derived potentials of GAI for the AEP teachers by the stakeholders

Executing this depth of competency mastery within the highly compressed, fast-tracked timeline of an AEP creates a severe pedagogical bottleneck. Teachers are expected to deliver a dynamic, highly

personalized curriculum to over-age learners, but lack the adaptive instructional tools required to merge CBC requirements seamlessly into the accelerated timeframe.

The Reality of the Classroom

This curricular friction is exponentially compounded by the daily, physical realities of the fragile classroom. Educational delivery in these settlements is plagued by severe structural vulnerabilities, primarily massive teacher shortages and drastically overcrowded learning spaces. In many refugee settlements, classrooms lack basic infrastructure, such as walls or electricity, making the learning environment physically arduous. Furthermore, teachers face immense language barriers; they are tasked with instructing culturally and linguistically diverse learners who rarely share a common mother tongue, let alone fluency in the official language of instruction.

Crucially, these classrooms are not merely academic environments but vital recovery ecologies. Learners bring complex histories of conflict, displacement, and poverty, introducing varying degrees of trauma and mental health challenges into the classroom. This reality necessitates rigorous trauma-informed pedagogy—the deliberate design of safe, predictable, and non-retraumatizing instructional spaces. Yet, teachers operating in these resource-starved settings are chronically overwhelmed; they lack the digital tools, data access, and psychosocial training needed to manage massive class sizes while simultaneously providing individualized trauma-sensitive care. Without intervention, these compounding pressures lead to high absenteeism, rigid learning paths, and inevitable dropout, stymieing the potential of highly vulnerable learners.

The Original GAI-ACT Vision and Targets

Leveraging LLMs for Dynamic Curriculum Delivery

To address the severe pedagogical bottlenecks of delivering the Competency-Based Curriculum (CBC) within the compressed Accelerated Education Programme (AEP), the original "Generative AI for Accelerated Competency-Based Teacher Training in Crisis Contexts (GAI-ACT)" proposal envisioned a direct, technology-driven intervention. The project posited that Generative Artificial Intelligence (GAI) represented a game-changing opportunity to bypass traditional material scarcity. The initial strategy was to build the techno-pedagogical capacities of frontline educators by training them to use existing, globally dominant Large Language Models (LLMs)—specifically ChatGPT and Gemini.

The educative core of this intervention was "prompt engineering." Rather than relying on outdated or non-existent textbooks, teachers would be trained to act as instructional designers, using structured prompts to dynamically generate CBC-aligned lesson plans, customize reading materials for diverse linguistic backgrounds, and create formative assessment rubrics on demand. By equipping teachers with these skills, the project aimed to provide real-time instructional support, reduce extreme teacher workload, and facilitate a highly interactive, personalized learning experience that matched the cognitive maturity of over-age refugee learners.

The Scaling Mechanism: The 1:9 ToT Cascading Model

Recognizing the vast scale of the educational crisis in Uganda's refugee-hosting districts, the proposal was engineered around a highly structured, cost-effective scaling mechanism: the Trainer-of-Trainers (ToT) cascading model. The direct target audience was not the learners, but the educators who serve them—specifically, ICT teachers aged 25 to 55 operating in fragile contexts.

The project strategically targeted 4 cohorts of these ICT teachers across 20 refugee camps (spanning 9 districts and 3 regions in Uganda) and 34 refugee-hosting schools. These primary beneficiaries were to be upskilled as "Master Trainers". Upon mastering prompt engineering and GAI-integrated curriculum delivery, each Master Trainer was tasked with mentoring and training their peers within their respective institutions. Operating on a strict 1:9 trainer-to-trainee ratio, the project projected it would practically build the capacities of 612 teachers across 9 to 11 different subject areas. Through this exponential capacity-building architecture, the project aimed to fundamentally elevate the quality

of education service delivery for the ultimate downstream beneficiaries: the highly vulnerable secondary-level learners aged 16 to 45 years.

Alignment with Strategic Goals
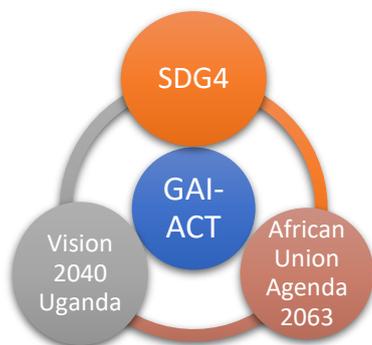
The original GAI-ACT proposal was not designed in a policy vacuum; it was deliberately anchored to national and international development frameworks to ensure that localized capacity building contributed to macro-level educational milestones.

- **Sustainable Development Goal 4 (SDG 4):** The project directly answered the mandate of SDG 4—ensuring inclusive and equitable quality education and promoting lifelong learning opportunities for all. By targeting refugee settlements, the project prioritized the globe's most marginalized populations, utilizing AI to bridge the severe equity gaps that plague crisis-affected education systems.
- **Uganda's Vision 2040:** The initiative aligned seamlessly with Uganda's national roadmap to transition from a predominantly peasant society to a modern and prosperous country. By upskilling teachers in advanced digital literacies and AI utilization, the project supported the national imperative to build a digitally competent workforce capable of thriving in the Fourth Industrial Revolution.
- **African Union Agenda 2063:** Finally, the project resonated with the AU's Agenda 2063 ("The Africa We Want"), particularly its emphasis on catalyzing education, science, technology, and innovation. By empowering African educators to leverage cutting-edge AI technologies, the proposal originally sought to ensure that fragile contexts were not left behind in the continent's digital transformation trajectory.

The GAI-ACT Accountability Matrix: Mapping Proposed Objectives to Realized Deliverables

This section traces the evolution of the GAI-ACT project, mapping the original objectives and research questions to the final deliverables achieved during the 17-month implementation cycle. By employing a participatory action research framework and directly responding to the realities of fragile learning environments, the consortium strategically expanded the project's scope to maximize its impact. What began as a targeted teacher-training initiative grew into a comprehensive, decolonial digital ecosystem. The resulting outputs—specialized Open Educational Resources (OERs), a sovereign e-learning platform, and localized Generative AI prototypes—illustrate how the project successfully answered its foundational research questions while delivering sustainable, locally anchored AI solutions for the education sector.

◎ **Objective 1: Teacher digital competence profiling in the use of Generative AI in refugee contexts.**

Research Question: What are the current capabilities and limitations of the teachers in using Generative AI in refugee contexts?
Original Deliverable: A competence and skills gap report on generative AI usage by teachers in refugee contexts.

How it was achieved: To answer this research question and produce the deliverable, the consortium moved beyond standard assessments and developed the comprehensive GAI Teacher Profiling Tool. Deployed before the capacity-building phase, this tool captured critical baseline data

across multiple dimensions: demographic contexts (e.g., AEP vs. mainstream), teaching competency, digital readiness (access to electricity, internet, devices), pedagogical practices, and AI attitudes/fears.

The profiling revealed that the limitations were not merely technical, but systemic. Many teachers lacked basic infrastructural access and expressed valid fears regarding AI hallucinations and data privacy. Furthermore, pre-training and post-training surveys were administered to quantitatively measure shifts in AI literacy, bias detection, and ethical awareness. The resulting analysis formed a robust competence and skills gap report that fundamentally shifted the project's understanding: the gap was not just at the grassroots teacher level, but originated upstream at the Teacher Training Institutions (TTIs) which were not producing AI-ready graduates.

Objective 2: Develop an accelerated competency-based training curriculum for trainers of trainees on the use of Generative AI in Teaching and Learning.

Research Question: What competencies are needed in GAI-driven instruction that can be incorporated into a teacher-training curriculum?
Original Deliverable:
-Accelerated Generative AI Teacher-Training Curriculum;
-Detailed Design Documents (DDD) for Course Instruction.

How it was achieved: The project vastly exceeded this deliverable. Initially proposing a single training curriculum, the consortium realized through co-creation Focus Group Discussions that a one-size-fits-all approach would fail. Stakeholders demanded capacity building at the governance and university levels first for institutional safeguarding.

Consequently, the competencies identified—ranging from institutional data privacy to trauma-sensitive prompt engineering—resulted in the co-design of 12 distinct, specialized Open Educational Resource (OER) courses rather than a single curriculum. We generated comprehensive Detailed Design Documents (DDDs) for each course, ensuring they were rigorously aligned with Competency-Based Curriculum (CBC) principles. The curriculum ecosystem includes:

- Higher Education Tracks (GAI-ED-001, 002, 003) for university lecturers.
- Governance Tracks (GAI-ADM-101, GAI-CRC-101) to build administrative competencies.
- Fragile Classroom Tracks (GAI-AEP-101, GAI-TIP-101, GAI-PSS-101) specifically targeting accelerated education, trauma-informed pedagogy, and psychosocial support.

Courses can be accessed via: https://rgai.educaifutures.com/

Objective 3: Competency-based training for leveraging Generative AI in accelerated curriculum delivery.

Research Question: How are the GAI competencies effectively leveraged by teacher trainers for accelerated curriculum delivery?
Original Deliverable:
-Rigorous Competency-based capacity building program;
-Openly accessible courses for GAI utilisation in accelerated curriculum delivery.

How it was achieved: To ensure competencies were effectively leveraged and scaled, the project operationalized a robust Trainer of Trainers (ToT) cascading model utilizing a 1:9 scaling ratio. We treated all participants—from Muni University lecturers to ICT teachers in refugee camps—as active Master Trainers and co-designers.

To fulfil the mandate for "openly accessible courses," the project recognized that static dissemination (like PDFs or printed manuals) would quickly become obsolete in the rapidly evolving AI landscape. Therefore, we democratized access by designing and deploying a Custom E-Learning Platform. This proprietary digital ecosystem hosts all courses as dynamic Open Educational Resources (OERs). The platform is deliberately engineered to be low-bandwidth and offline-friendly (supporting portable media distribution) to accommodate the infrastructural realities of refugee settlements, allowing teachers to continuously access and leverage GAI competencies for accelerated curriculum delivery.

Details can be accessed via: https://rgai.educaifutures.com/

Objective 4: Prompt Engineering for Dynamic and Equitable Curriculum Delivery.

Research Question: What practices for prompt engineering are applicable to accelerated curriculum instruction in refugee contexts?
Original Deliverable:
-Prompt Engineering training manuals;
-Corpus of Prompts for curriculum delivery.

How it was achieved: The project identified that standard prompt engineering was insufficient and potentially harmful in fragile contexts due to the Western biases of global LLMs. We answered the research question by pioneering the practice of "Speculative Epistemic Auditing"—training teachers to use prompt engineering not just for efficiency, but as a critical literacy practice to actively mitigate algorithmic bias, enforce cultural nuances, and reclaim epistemic control.

The deliverables were achieved by embedding specialized Prompt Engineering Training Manuals directly into the core modules of the OERs (e.g., GAI-PRI-101, GAI-SEC-101, GAI-AEP-101). Furthermore, the ToT participants collaboratively co-created a Corpus of Prompts (Prompt Libraries) tailored explicitly for the Ugandan CBC and AEP contexts (e.g., prompts designed for multilingual scaffolding, trauma-sensitive lesson planning, and low-resource activity generation).

Resources can be accessed via: https://rgai.educaifutures.com/

Objective 5: Ascertaining the problems and challenges that impede learning outcomes and use of generative AI for Accelerated curriculum instruction in refugee context by the Teacher Trainers.

Research Question: What are the problems and challenges that impede learning outcomes and use of generative AI for Accelerated curriculum instruction in refugee context?
Original Deliverable: Benchmarks and guidelines on the potential impediment of generative AI adoption for Accelerated curriculum instruction in the refugee context.

How it was achieved: Through our participatory action research and focus group discussions, we successfully ascertained the most critical impediments to AI adoption. The primary challenges were not merely infrastructural; they were epistemic and institutional. We identified the "Buzzword Barrier" (stakeholders halting scale-up due to a lack of safeguarding mechanisms), the gap in Teacher Training Institutions (universities failing to produce AI-ready teachers), and the Hallucination Crisis (foreign LLMs exhibiting severe epistemic erasure, ignoring local languages, and fabricating content).

We delivered comprehensive benchmarks and ethical guidelines, most notably formalized in the Data Sharing Agreements and the institutional governance tracks (GAI-ADM-101).

However, the project went a massive step further than just reporting on these impediments. To permanently solve the impediment of foreign AI dependency and hallucinations, the consortium utilized the established guidelines to benchmark and co-create two sovereign Generative AI Support Tool Prototypes—one explicitly fine-tuned for the Competency-Based Curriculum (CBC) and one for Accelerated Education Programming (AEP).

Navigating Ground Realities: Strategic Pivots and Profound Lessons Learned

This section provides transparent accountability to CODE, documenting exactly how and why the project deviated from its original proposal. In the Global South, the linear deployment of imported technology into fragile ecosystems frequently fails because it ignores localized systemic friction. By embracing a participatory action research framework, our consortium treated operational friction not as a barrier, but as vital diagnostic data. The following sub-sections educate EdTech Stakeholders, policymakers, and practitioners on the realities of implementing Generative AI in crisis contexts, demonstrating how agile, responsive project management transformed initial hurdles into sustainable, system-wide capacity building.

Pivot 1: The "Buzzword" Barrier and Institutional Safeguarding

The Reality: The Abstract Nature of AI and the Demand for Governance

According to the original GAI-ACT proposal, the immediate priority was to cascade prompt-engineering training directly to ICT teachers across 34 refugee-hosting schools. However, during our initial Focus Group Discussions (FGDs) and co-creation workshops, we encountered a critical systemic roadblock. It became immediately evident that to high-level stakeholders—including district education officers, headteachers, Ministry representatives, and NGO partners—Generative AI was largely an abstract "buzzword." It lacked practical, contextual meaning for the realities of their education systems.

Figure 4. Stakeholder Engagement

Figure 5. Collecting feedback form Stakeholders Phase 1

Because they did not fundamentally understand the underlying technology, its data mechanisms, or its long-term implications, these stakeholders rightfully felt unequipped to engage with, approve, or support the project's implementation. They appreciated the novelty of the intervention but invoked their duty of institutional safeguarding. They recognized that approving a technology they could not understand—especially one that would interact with vulnerable refugee populations and highly compressed Accelerated Education Programmes (AEP)—posed severe regulatory and ethical risks. Consequently, they withheld their support for any national scaling or classroom-level deployment.

Figure 6. Co-designing a Realistic Safe Institutionally Acceptable Approach to research with the Stakeholders

Figure 7. Getting Structural Feedback and safe guarding from stakeholders

This pushback was not a rejection of innovation, but a profound demonstration of local agency and institutional control; they demanded that their own governance capacities be built first so they could effectively regulate the technology.

The Response: A "Governance-First" Capacity Building Approach

Figure 8. Training Stakeholders on what AI is and What it can do for Competency-based Teaching and Learning In Fragile contexts.

Figure 9. Hands on training of Stakeholders to build the capacity of Stakeholders
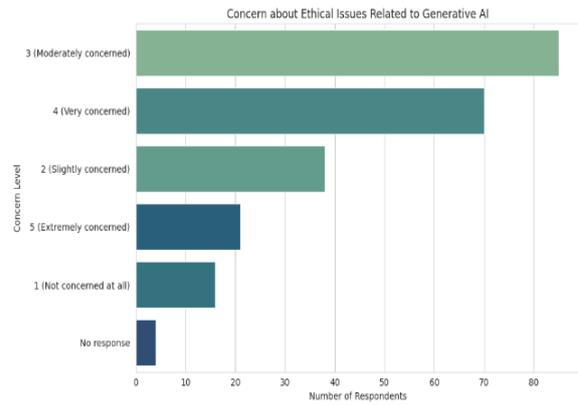
Figure 10. Many respondents expressed high or moderate concern about ethical issues related to using generative AI in their studies, indicating that ethical considerations are a prominent aspect of AI tool utilization.

Recognizing the absolute validity of these concerns, the GAI4Educ consortium immediately suspended the planned deployment of technology into the classrooms. We realized that introducing Generative AI to teachers without the informed consent and regulatory backing of their administrators would create unsanctioned, high-risk technological environments. We strategically pivoted from a "deployment-first" model to a "governance-first" model, dedicating our initial efforts to bringing these crucial stakeholders on board.

Figure 11. Further Training of Stakeholders on Generative AI
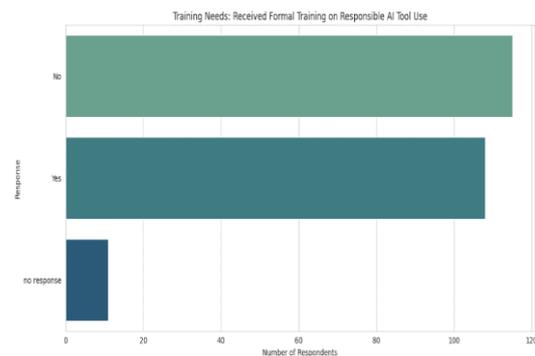
Figure 12. A significant portion of respondents have not received formal training from their university training on responsible AI tool use. This highlights a critical training gap that universities need to address to ensure ethical and effective AI integration.

To achieve this, we developed and delivered a specialized course: GAI-ADM-101 (Foundations of Generative AI for Administrative and Service Roles). This course was meticulously designed to demystify AI for educational leaders, focusing on data privacy, ethical boundaries, digital security, institutional accountability, and policy interpretation. By training the administrators and policymakers first, we transformed their apprehension into informed, critical technological literacy. Once they understood the potential benefits and the tangible harms (such as data colonialism, algorithmic bias, and privacy breaches), they were able to confidently establish safe regulatory frameworks and institutional guardrails. This pivot ensured that when we finally initiated teacher training, it was conducted within a legally secure, institutionally supported, and ethically regulated environment, embedding long-term sustainability into the project's foundation.
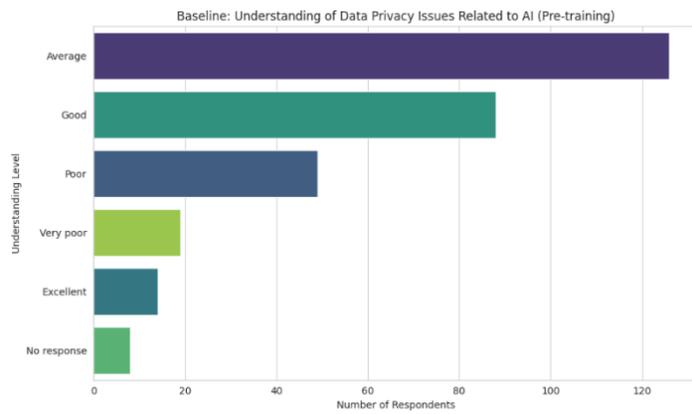
Figure 13. Before training, most respondents had an average or good understanding of data privacy issues related to AI, but a notable portion reported poor or very poor understanding, highlighting an area needing attention

Pivot 2: The Teacher Training Institution (TTI) Gap and Muni University

The Reality: Systemic Disparities and the "AI-Ready" Teacher Pipeline
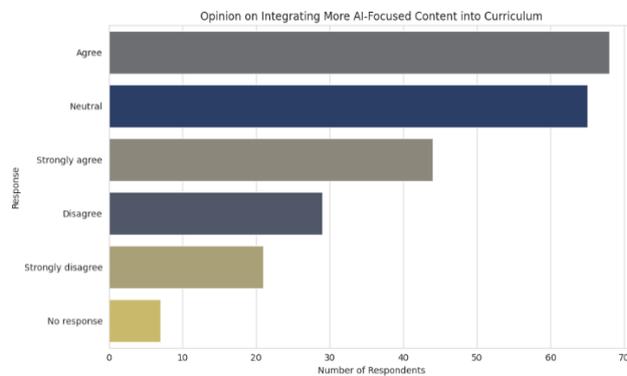
Figure 14. A significant majority of respondents believe their institution should integrate more AI-focused content into the curriculum, underscoring a strong demand for AI education within academic settings.

As the project initiated its early engagement phases, critical feedback from stakeholders illuminated a profound systemic blind spot in the original GAI-ACT proposal. The initial project design focused exclusively on training in-service ICT teachers already operating within refugee camps and host communities. However, educational policymakers and district officials astutely identified that targeting only active teachers was a reactive, short-term band-aid rather than a sustainable systemic cure. They highlighted a severe foundational gap: Uganda's universities and Teacher Training Institutions (TTIs) were not producing "AI-ready" graduates.

The stakeholders warned that deploying advanced Generative AI tools solely to current educators in targeted camps would inadvertently and indefinitely widen existing educational disparities. It threatened to create new technological divides between rural and urban schools, between government and private secondary institutions, and between mainstream (formal) classrooms and Accelerated Education Programming (AEP) environments. If the national teacher pipeline continued to pump out graduates with zero techno-pedagogical AI skills, the project's impact would evaporate the moment trained teachers left the profession. For the intervention to be scalable and sustainable at a national level, the root of teacher preparation—the universities—had to be addressed.

The Response: Upskilling Higher Education to Co-Design the Future

Comparative Analysis: Utilization vs. Pre-training AI Skills (Visualisation 5/5)
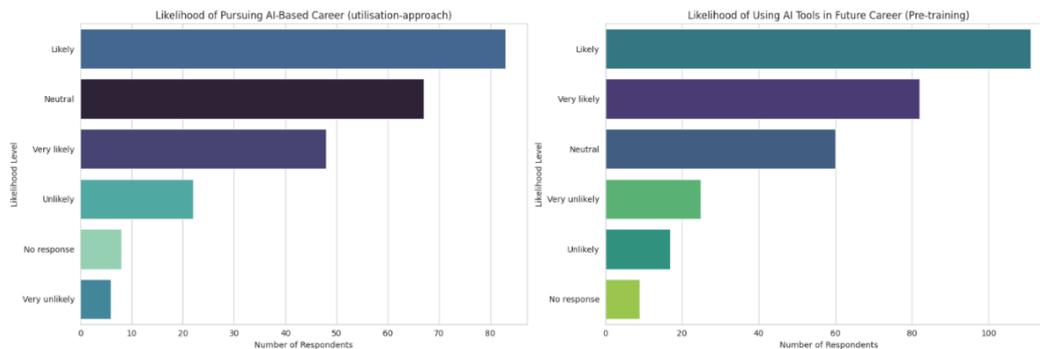
Figure 15. Both visualizations highlight a strong inclination among respondents towards integrating AI into their future professional lives. A large majority in both participants indicated being "Likely" or "Very likely" to use AI tools in their future careers or pursue an AI-based career. This suggests that respondents recognize the growing importance of AI in the job market and are prepared to adapt their skills accordingly. Training materials should capitalize on this existing interest by focusing on practical, career-relevant AI applications and skill development

Acting on this critical insight, the consortium made a strategic pivot to secure the teacher training pipeline. Following stakeholder recommendations to prioritize the country's most vulnerable and heavily refugee-populated regions, the project partnered strategically with Muni University in Northern Uganda, a premier TTI serving the region.

Figure 16. Training Pre-service teachers

However, upon engaging Muni University, the project encountered a secondary layer of operational friction: the university lecturers and teacher trainers exhibited strong resistance to adopting and integrating AI methodologies into their syllabi. This resistance was not born of defiance, but of a genuine lack of capacity; the university staff could not be expected to train pre-service teachers on complex Generative AI tools when they themselves had not been trained. They required the same institutional safeguarding and capacity building that the district administrators had demanded.

In response, the project pivoted upstream, pausing the development of secondary-level materials to first build the capacity of Muni University's lecturers, administrators, and non-teaching staff. To achieve this, the consortium developed three highly specialized Higher Education Open Educational Resource (OER) tracks:

- GAI-ED-001 (Introduction to Generative AI): A beginner's track designed to establish foundational AI literacy for university educators.
- GAI-ED-002 (Enhancing Education with Generative AI): An intermediate track focusing on integrating AI into Competency-Based Curriculum (CBC) delivery in higher education, customized learning paths, and advanced assessment techniques.
- GAI-ED-003 (Generative AI for Advanced Educational Practices): An advanced track empowering academic researchers and lecturers to use AI for grant writing, thesis structuring, and implementing AI-driven learning analytics.

Figure 17. Training Educators at Muni University

Figure 18. Engagement of Staff into critical discussions about Generative AI for Teacher Training in Fragile contexts

This pivot yielded a profound return on investment. Once the capacity of the university lecturers was built, their resistance dissolved into enthusiastic ownership. These newly empowered university stakeholders transitioned into active co-designers. They brought their deep pedagogical expertise to the table, collaborating with the consortium to co-create the subsequent AI courses tailored for both pre-service teachers (still in the institution) and in-service teachers already deployed in fragile contexts. By investing in the TTIs first, the project successfully transformed Muni University into a self-sustaining hub of AI educational innovation for Northern Uganda.

Pivot 3: The Hallucination Crisis and Local AI Prototyping

The Reality: Foreign AI Dependency, Epistemic Erasure, and the Hallucination Crisis

Under the original GAI-ACT proposal, the technological strategy relied heavily on training ICT teachers to utilize existing, globally dominant Large Language Models (LLMs) such as ChatGPT and Gemini. However, as the Master Trainers began executing advanced prompt engineering exercises during the capacity-building phase, a severe operational and ethical crisis emerged. The foreign LLMs exhibited profound Western biases and a structural inability to accurately reflect the lived realities of Ugandan fragile contexts. This manifested as "**epistemic erasure**"—the models consistently ignored local languages, marginalized African pedagogical traditions, and defaulted to Euro-American cultural examples (e.g., generating lesson plans based on a four-season temperate climate rather than Uganda's equatorial wet and dry seasons)

Figure 19. Staff reflecting and other LLM outputs after realising the tools were not as perfect as they expected during the training.
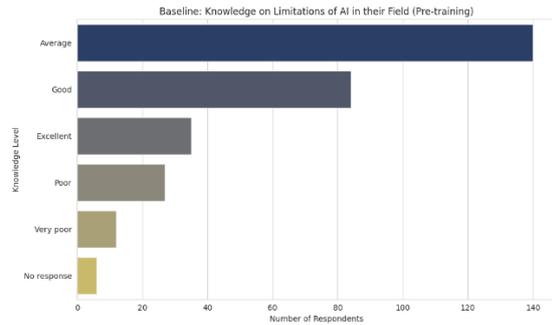
Figure 20.Figure 6: Most respondents rated their current knowledge of AI limitations as average or good, suggesting an awareness of AI boundaries, but also a need for deeper understanding of its practical constraints

More alarmingly, when teachers prompted these models for specific, localized content aligned with the Ugandan Competency-Based Curriculum (CBC) or Accelerated Education Programme (AEP), the foreign LLMs produced exceptionally high rates of "hallucinations"—generating plausible-sounding but entirely fabricated and factually incorrect educational material.

During the iterative focus group discussions, institutional stakeholders and university partners flagged this reality not merely as a technical glitch, but as a critical sustainability and "data colonialism" threat. They recognized that if Ugandan teachers became dependent on foreign, proprietary tech monopolies to deliver their national curriculum, it would lock the education system into a perpetual cycle of subscription fees and epistemic dependency. Furthermore, channeling local educational queries and intellectual labor into foreign servers constituted a form of digital extractivism, enriching external algorithms without building sovereign, local digital infrastructure. The stakeholders made it clear: sustainable AI integration could not mean passive consumption of biased foreign technologies.

The Response: Evolving from Using AI to Building Sovereign AI Prototypes

Figure 21. Lack of reliability/accuracy and ethical concerns are the most frequently cited challenges when using generative AI tools, indicating critical areas that training programs should address.

Faced with the profound risk of digital colonialism and the immediate pedagogical dangers of AI hallucinations, the project executed its most ambitious and transformative pivot: it evolved from simply training teachers to use AI to empowering the consortium to build AI. To guarantee long-term educational sovereignty, the project initiated an intensive benchmarking process and transitioned the trained educators from passive end-users into active co-designers of their own technological solutions.

Leveraging the Data Sharing Agreements established with partners like War Child Canada and NCDC, the consortium utilized anonymized, locally curated datasets—comprising actual curriculum documents, teacher reflections, and classroom artifacts—to co-create two distinct, sovereign Generative AI support tool prototypes:

1. **The CBC AI Support Prototype:** This tool was fine-tuned explicitly on the Ugandan Competency-Based Curriculum, local pedagogical contexts, and culturally relevant data to eliminate Western-centric hallucinations. In a major milestone for institutional sustainability and scale, this prototype has been officially handed over to the National Curriculum Development Centre (NCDC) to adopt, regulate, and scale nationally. Crucially, it remains open-source, allowing educators and researchers to continue experimenting with and refining the model without restrictive paywalls.
   Access the Prototyped tool Here: https://cbcncdc.neuralsecurify.cloud/

2. **The AEP AI Support Prototype:** Recognizing that accelerated and fragile learning environments require fundamentally different pedagogical logic, a second generative AI tool was developed specifically for the Accelerated Education Programme. This prototype is engineered to handle AEP-specific parameters, including curriculum compression, multilingual bridging, and trauma-informed phrasing. This specialized tool is currently finalized and pending official handover to the relevant stakeholders for AEP programming and policy support integration.
   Access the Prototyped tool Here: https://aep.neuralsecurify.cloud/

The Educative Core for EdTech Stakeholders: This strategic pivot generated a profound lesson for global digital development. It demonstrated that deploying foreign AI into the Global South without local contextualization is a flawed, high-risk strategy that ultimately creates more pedagogical barriers than it solves. True educational innovation and sustainability require EdTech Stakeholders to invest in local data infrastructure, participatory co-design, and sovereign AI model development, ensuring that the technology serves the educators, rather than the educators serving the technology.

Methodology: Participatory Action Research and Epistemic Auditing

This section details the rigorous, decolonial research methods utilized to engage educational communities throughout the implementation of the project. Recognizing that top-down technological deployments frequently fail in the Global South due to a lack of contextual grounding, the consortium anchored the project in a Participatory Action Research (PAR) paradigm. This methodology was specifically designed to shift educators from being passive consumers of imported technology to becoming active co-researchers, critical auditors, and sovereign designers of their own digital teaching environments.

The Trainer of Trainers (ToT) Capacity-Building Model: - To ensure that the integration of Generative AI was both scalable and sustainably rooted in local educational ecosystems, the project eschewed traditional, centralized training models in favor of a robust Trainer of Trainers (ToT) cascading framework.

The ToT Strategy: Teachers as Active Co-Designers and Master Trainers
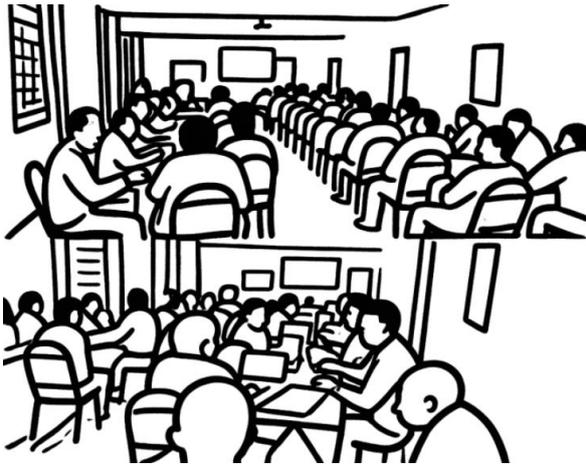
Figure 22. Training Teachers in Fragile Contexts

Figure 23.Extracted feedback gathered from Trained Teachers on what AI can potentially do for them.

The strategic core of the capacity-building model was the deliberate positioning of all participants—ranging from university lecturers at Muni University to ICT teachers operating in remote refugee camps—as active co-designers rather than mere end-users of technology. The project identified and targeted four cohorts of ICT teachers across 20 refugee camps and 34 refugee-hosting schools to serve as initial "Master Trainers".

Utilizing a highly structured 1:9 scaling ratio, each Master Trainer was equipped not only with the technical skills to leverage Generative AI but also with the pedagogical and ethical frameworks required to safely cascade this knowledge to their peers. This exponential scaling mechanism was designed to practically build the capacities of 612 secondary-level teachers across 9 to 11 subject areas.

Crucially, the ToT strategy was grounded in a co-learning methodology. As Master Trainers engaged with AI tools (such as ChatGPT, Gemini, and the customized local LLM), they were tasked with collaboratively developing culturally inclusive "prompt libraries" and lesson plans aligned with the Competency-Based Curriculum (CBC) and Accelerated Education Programme (AEP). By embedding peer mentoring, community-of-practice hubs, and collaborative Open Educational Resource (OER) authorship into the ToT lifecycle, the project restored professional dignity and agency to educators operating in marginalized, low-resource environments.

Readiness Assessment: Deploying the GAI Teacher Profiling Tool

To guarantee that the capacity-building interventions were precisely calibrated to the realities of the fragile classroom, the project required rigorous diagnostic data before initiating any AI training. To achieve this, the consortium developed and deployed the comprehensive GAI Teacher Profiling Tool, a structured assessment instrument designed to capture baseline data across multiple dimensions of educator readiness.

The profiling tool systematically evaluated the following critical domains:

- **Demographics and Contextual Realities:** Capturing the specific operational contexts of the educators, including their subject specializations, involvement in the Accelerated Education Programme (AEP), and their tenure teaching within refugee or displaced community settings.
- **Teaching Competency & Digital Readiness:** Auditing the actual infrastructural constraints faced by the teachers, measuring access to foundational utilities like electricity, internet connectivity, and personal devices, while simultaneously evaluating their baseline confidence in utilizing ICT tools.

- **Pedagogical Practices and Policy Awareness:** Assessing whether teachers predominantly utilized teacher-centered or learner-centered instructional methods, their alignment with national CBC policies, and the frequency of pedagogical mentoring they received from district or NGO supervisors.
- **AI Readiness, Attitudes, and Resilience:** Moving beyond mere hardware availability, the tool probed the educators' psychological and ethical readiness for AI. It explicitly measured their primary concerns regarding Generative AI, such as fears of factual inaccuracy, student over-reliance, data privacy risks, and the cultural relevance of AI-generated content. It also asked teachers to identify their personal strengths (e.g., empathy, flexibility) and weaknesses (e.g., limited digital skills, burnout) in navigating fragile contexts.
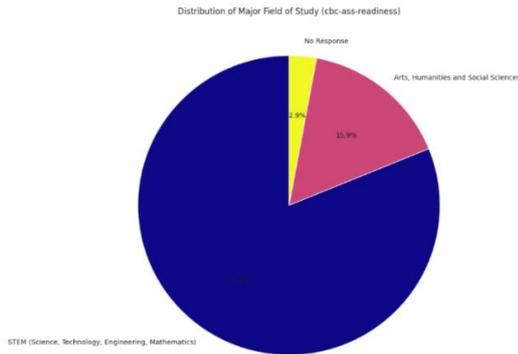
Figure 24.This pie chart illustrates that a significant majority of respondents are from STEM fields, followed by Arts, Humanities, and Social Sciences. A small percentage did not provide a response.
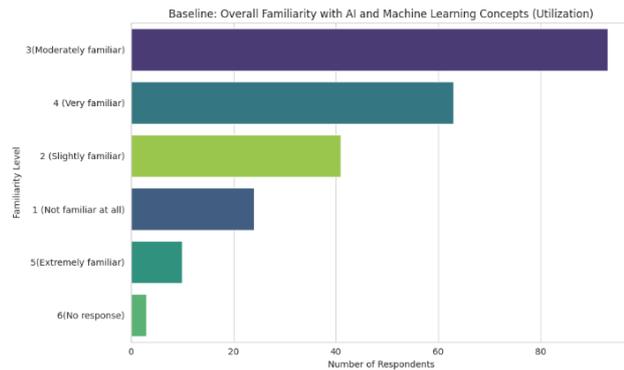
Figure 25.The plot shows that a significant portion of respondents have moderate familiarity with AI and machine learning concepts before using AI tools. This suggests a foundational understanding exists, but training needs to cater to varying levels, from beginners to those seeking deeper knowledge.

The Educative Insight for EdTech Stakeholders: The deployment of the GAI Teacher Profiling Tool was a critical step in avoiding the "design-reality gap" common in EdTech interventions. The baseline data proved that many teachers lacked consistent access to electricity and internet, and were deeply concerned about AI hallucinations. Consequently, the project was able to proactively adapt its methodology, ensuring that the resulting OERs and prompt engineering training were highly optimized for low-bandwidth, offline-friendly implementation, directly responding to the infrastructural precarity of the target audience.

Speculative Epistemic Auditing

To rigorously understand how imported Generative AI behaves in Ugandan fragile contexts, the project rejected standard, passive technology evaluation models. Instead, the consortium deployed Speculative Epistemic Auditing, an innovative, participatory methodology that served as the primary research engine of the GAI-ACT project. This approach was designed not only to measure technical errors but to actively expose the cultural, linguistic, and historical distortions embedded within foreign Large Language Models (LLMs).

Shifting Power Dynamics: From Passive End-Users to Critical Auditors

The Reality: At the onset of the project, ICT teachers in refugee and host communities were positioned by global technology narratives as passive consumers of imported AI tools. Because these models are predominantly trained on Western corpora, they enact "epistemic path dependencies"—systematically privileging Eurocentric knowledge and temperate-climate examples over equatorial realities and African pedagogical wisdom. If left unchecked, the uncritical adoption of these LLMs would transform teachers into mere "quality assurance assistants" for foreign tech monopolies, deepening digital colonialism.

The Methodological Response: To shift this power dynamic, the capacity-building framework transitioned teachers into "critical auditors" of algorithmic bias. The project anchored this transformation in three powerful, culturally resonant frameworks:

- **Decolonial AI:** This framework shifted the mindset from technological consumption to the co-creation of sovereign technological futures, empowering teachers to resist cognitive imperialism and data extractivism.
- **Ubuntu (Relational Ontology):** By centralizing the philosophy of "I am because we are", teachers were taught to critique the inherent individualism of Western AI models, demanding that AI outputs respect communal well-being, collective learning, and local pedagogical wisdom.
- **Afrofuturism & Speculative Fabulation:** To break the narrative of "promissory determinism" (the idea that Western tech trajectories are inevitable), teachers engaged in speculative storytelling. They created "objects to think with"—tangible artifacts, maps, and narratives that envisioned how AI should look if designed by and for African educators.

The Educative Insight for EdTech Stakeholders: By equipping teachers with the vocabulary of "epistemic justice" (recognizing testimonial and hermeneutical injustices), the project proved that technical training is insufficient in the Global South. True capacity building requires cultivating "Futures Literacy," providing educators with the intellectual agency to challenge algorithmic authority, demand cultural relevance, and reclaim ownership of their digital teaching environments.

The Auditing Process: Quantifying Bias and Proving the Need for Localization

The Experimental Design: To empirically diagnose the harms LLMs inflict on local knowledge systems, the project executed a controlled, within-subjects auditing design (paired observations). The ICT teachers acted as their own controls, conducting structured testing sessions using tools like ChatGPT and Gemini.

The Auditing Protocol: Teachers engaged the LLMs under two distinct conditions to generate comparative audit data:

1. **Baseline Condition (Unprompted/No Prompt Engineering):** Teachers entered standard, unstructured educational queries typical of a novice user.
2. **Intervention Condition (Culturally Nuanced Prompting):** Teachers applied strategic, highly structured prompt engineering skills acquired during their training, specifically injecting local context, language parameters, and cultural constraints into their queries.

Measurement and Findings: The outputs generated under both conditions were rigorously evaluated using a standardized Output Scoring Rubric on a 5-point ordinal scale. The teachers quantitatively and qualitatively graded the AI outputs against four critical criteria:

- Factual Accuracy: Detecting general model failures and incorrect historical or scientific facts relevant to Uganda.
- Cultural Appropriateness: Measuring misalignment with local norms, idioms, and examples.
- Epistemic Integrity: Assessing whether the output respected Indigenous Knowledge Systems (IKS) and local pedagogy.
- Hallucination Frequency: Tracking the generation of plausible-sounding but entirely fabricated information (e.g., inventing local historical figures).

The Educative Insight for EdTech Stakeholders: This auditing process yielded profound empirical evidence. It proved mathematically and qualitatively that without intervention, foreign LLMs hallucinate heavily and systematically erase Ugandan realities. More importantly, the within-subjects comparison unequivocally proved the efficacy of the project's intervention: localized prompt engineering is not merely a technical efficiency skill; it is a mandatory safeguarding mechanism. By documenting this through interaction logs, screen recordings, and reflexive notes capturing the teachers' frustration and ultimate empowerment, the project demonstrated that the only way to

utilize global AI in fragile contexts is to train educators to aggressively boundary and command the technology.

Key Output 1: The Co-Created Open Educational Resources (OERs)

The original proposal objectives outlined a central objective: to develop an "Accelerated Generative AI Training Curriculum" supported by Detailed Design Documents (DDDs) to build the capacity of ICT teachers operating in refugee camps. The initial vision was to equip these teachers with prompt engineering skills for dynamic and equitable curriculum delivery. However, as the project adapted to the realities of institutional safeguarding and systemic capacity gaps, this singular training objective evolved into a comprehensive, multi-layered educational ecosystem.

To guarantee that the original goals of scalable, ethical, and competency-based AI integration were met sustainably, the consortium co-created highly specialized Open Educational Resources (OERs). Rather than a one-size-fits-all manual, these courses were packaged as reusable, openly accessible learning materials meticulously tailored for pre-service teachers, in-service teachers, administrators, and university lecturers.

Below is the detailed catalog of the OERs, demonstrating how each distinct track contributes directly to fulfilling the foundational objectives of the GAI-ACT proposal.

(Note: Detailed Design Documents for each course are provided as open-source links via: https://rgai.educaifutures.com/).

Higher Education & General Educator Tracks (a case of Muni University)

The original approach relied on a Trainer-of-Trainers (ToT) cascading model to scale knowledge across 34 refugee schools. However, to ensure this ToT model did not collapse after the funding cycle, the project had to anchor it within Teacher Training Institutions (TTIs) like Muni University.

Figure 26. Designing Courses for the AEP Teachers

Figure 27. Peer feedback sessions among course designers during Course Design

This track ensures that the institutions producing tomorrow's teachers are fully equipped to drive the project's original goal of "leveraging Generative AI in accelerated curriculum delivery".

- **GAI-ED-001: Introduction to Generative AI (Beginners Course for Educators):** This course establishes baseline AI literacy, defining core components, applications, and ethical considerations for educators who initially viewed AI as an intimidating buzzword.

  - ○ **Link to Proposal Objectives:** It directly satisfies the proposal's mandate to establish foundational digital literacy and hands-on tool setup (e.g., ChatGPT) before advancing to prompt engineering.

- **GAI-ED-002: Enhancing Education with Generative AI (Intermediate):** This track moves beyond basic literacy to focus heavily on integrating AI into Competency-Based

Education (CBE), developing personalized learning paths, and constructing comprehensive exams.

- o **Link to Proposal Objectives:** It directly answers the proposal's primary objective to "Develop an accelerated competency-based training curriculum". It trains university lecturers to align AI-generated materials with rigid competency frameworks, ensuring that the teachers they graduate are ready for Uganda's new curriculum demands.

- **GAI-ED-003: Generative AI for Advanced Educational Practices (Advanced):** Targeted at researchers and lecturers, this course covers AI in grant writing, thesis structuring, and AI-driven learning analytics.

  - o **Link to Proposal Objectives:** The CODE proposal committed to an "action-based mixed research approach" to continually evaluate the efficacy of AI in fragile contexts. By empowering local university researchers with advanced AI evaluation tools, the project ensures that empirical research on AI in refugee education remains locally driven and globally relevant.

(Access the OER Detailed Design Documents for the Higher Education Tracks here: [Insert Link to GAI-ED-001, 002, 003 DDDs])

Systems, Support, and Administration Tracks (The Governance Shield)

For AI to reach the fragile classroom safely, the regulatory environment surrounding it must be secure. The original proposal emphasized "Ethical Considerations and Cultural Sensitivity" and mitigating "potentially damaging effects of GAIs". This track institutionalizes those safeguards.
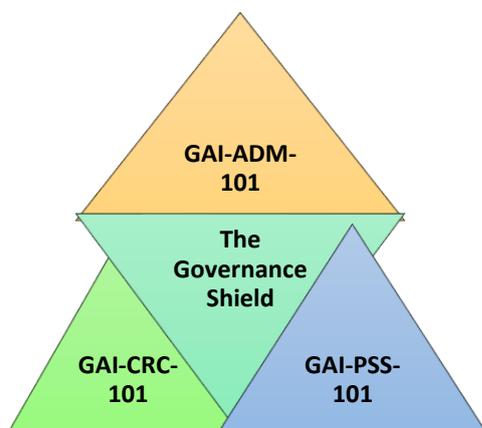
Figure 28. Story Boarding during Course design

- **GAI-ADM-101: Foundations of Generative AI for Administrative and Service Roles:** Designed for institutional leaders, administrators, and NGO coordinators, this course focuses on data privacy, secure workflows, and the responsible handling of institutional information.

  - o **Link to Proposal Objectives:** It operationalizes the proposal's commitment to data protection and ethical deployment. By training the administrators who regulate the schools, the project secured the institutional approval necessary to scale the ToT model nationally.

- **GAI-CRC-101: Foundations of Generative AI for Curriculum Systems in Mainstream and Fragile Contexts:** This course trains curriculum developers, quality assurance staff, and examiners (including NCDC and UNEB stakeholders) to use AI for needs analysis, content sequencing, and gap analysis.

- **Link to Proposal Objectives:** It directly answers the research question: "What impact might Generative AI have on accelerated curriculum delivery?". By aligning AI outputs with official national assessment standards, it ensures the AI-generated curriculum is legitimate and recognizable by state bodies.

- **GAI-PSS-101: Foundations of Responsible Generative AI for Psychosocial and Learner Support:** This course equips educators to use AI to generate low-risk emotional check-ins, supportive communication, and wellbeing routines.

  - **Link to Proposal Objectives:** The original proposal stressed the role of education in "minimising the vulnerabilities of children and adolescents impacted by war and disaster". This course ensures that AI is used to enhance psychosocial care in refugee camps, strictly defining the boundaries where AI support ends and human professional counseling begins.

(Access the OER Detailed Design Documents for the Systems & Admin Tracks here: [https://rgai.educaifutures.com/])

School and Teacher-Focused Tracks (The Fragile Classroom Application)

This is the operational heart of the project, delivering the targeted, hands-on pedagogical support promised to the ICT Master Trainers operating in Uganda's refugee settlements.
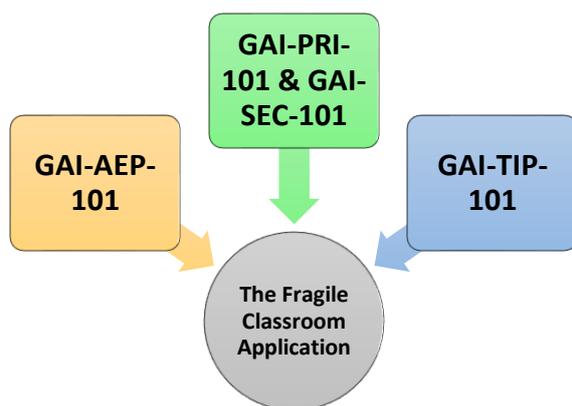
Figure 29. Story boarding for AEP Trauma informed pedagogy

- **GAI-PRI-101 & GAI-SEC-101: Foundations of Generative AI for Primary and Secondary School Teaching:** These complementary courses train mainstream teachers to use AI for lesson planning, activity generation, resource adaptation, and prompt engineering tailored to their specific grade levels.

  - **Link to Proposal Objectives:** Fulfils the core deliverable of providing "Prompt Engineering training manuals" and building the capacity of teachers across 9-11 different subjects. It ensures teachers can generate localized, low-cost instructional materials.

- **GAI-AEP-101: Generative AI for Accelerated Education Programming:** A highly specialized 15-module course targeting the unique realities of AEP: curriculum compression, language mismatch, overcrowding, and over-age learners.

  - **Link to Proposal Objectives:** This is the direct realization of the grant's namesake: "Generative AI for Accelerated Competency-Based Teacher Training in Crisis Contexts (GAI-ACT)". It fulfils the objective of adapting prompt engineering specifically to generate equitable delivery for learners whose education was interrupted by conflict.

- **GAI-TIP-101: Foundations of Trauma-Informed Pedagogy with Generative AI:** This course trains educators to use AI to design predictable routines, accessible materials, and lower-threat assessments for traumatized learners.

  - *Link to Proposal Objectives:* It meets the proposal's mandate to integrate "cultural sensitivity and contextually relevant for real-life inclusive educational practices". It establishes rigorous clinical "no-go zones," ensuring AI is never used for diagnosis or forced trauma disclosure, thereby safeguarding vulnerable refugee populations.

(Access the OER Detailed Design Documents for the Teacher-Focused Tracks here: [https://rgai.educaifutures.com/])

The Learner-Focused Track

While the original approach primarily targeted ICT teachers, participatory feedback revealed that as teachers adopted AI, learners would inevitably interface with AI-generated content. To ensure holistic educational integrity, the project expanded its beneficiaries to include the learners themselves.
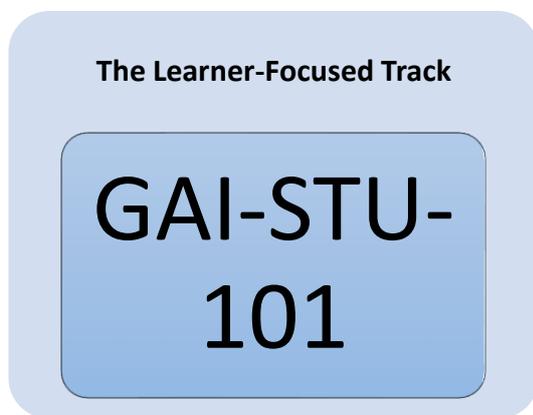
Figure 30. Validation of Courses developed

- **GAI-STU-101: Learner Foundations for Responsible Generative AI Use:** This course is designed directly for students, teaching them what Generative AI can and cannot do. It covers academic integrity, safe use, avoiding over-reliance, and detecting hallucinations and bias.

  - **Link to Proposal Objectives:** The ultimate goal of the CODE grant was to improve "educational outcomes for secondary-level learners aged 16 to 45 years". By equipping students with the critical literacy to evaluate AI outputs and use technology for brainstorming rather than cheating, this track ensures that the introduction of AI into fragile contexts empowers independent thinking and genuine competency acquisition.

(Access the OER Detailed Design Document for the Learner-Focused Track here: [https://rgai.educaifutures.com/)

Key Output 2: Democratizing Access via the Custom E-Learning Platform

While the co-creation of the specialized courses represented a massive pedagogical achievement, the consortium recognized that the *distribution* of these materials was just as critical as their development. In fragile contexts, knowledge hoarding and inaccessible digital infrastructure are primary drivers of educational inequality. To guarantee that the capacity-building efforts of the GAI-ACT project outlived the 17-month funding cycle, the project designed and deployed a custom, proprietary Open Educational Resource (OER) E-Learning Platform. This platform serves as the

sovereign digital ecosystem that houses, democratizes, and sustains the project's outputs for ICT teachers and educational stakeholders globally.

Rationale for an Independent Digital Ecosystem

Overcoming the Limitations of Static Dissemination:

Historically, educational interventions in the Global South have relied on static dissemination methods—such as printed training manuals or uneditable PDFs. However, Generative AI is an exponentially evolving field; interface designs, model capabilities, and hallucination patterns shift monthly. A static manual on prompt engineering would be obsolete within a year. By establishing an independent digital ecosystem, the project secured a dynamic, centralized repository capable of hosting the full suite of OER courses, expansive prompt libraries, and AI-generated teaching aids. Furthermore, by building a proprietary platform rather than relying on commercial third-party hosting, the consortium retained absolute digital sovereignty, ensuring that the resources remain openly licensed (e.g., Creative Commons) and permanently free from commercial paywalls or data-mining by foreign tech monopolies.

Accommodating the Infrastructural Realities of Refugee Settlements:

The deployment of the *GAI Teacher Profiling Tool* during the baseline research phase revealed stark infrastructural precarity among the targeted ICT teachers. A significant limiting factor across the 34 targeted AEP schools was the lack of reliable electricity, limited device access (often restricted to shared smartphones), and severe internet bandwidth constraints. An e-learning platform heavy in high-definition video or requiring constant cloud connectivity would have immediately excluded the most vulnerable educators. To solve this, the platform architecture was deliberately engineered to be low-bandwidth and offline-friendly. Course modules were designed to be lightweight, mobile-responsive, and easily downloadable. Crucially, the platform allows Master Trainers to download entire course structures, prompt libraries, and teaching aids onto portable media (such as USB flash drives) for offline, peer-to-peer dissemination within deep-rural refugee settlements. This ensured that the digital divide was bridged rather than widened.

Dynamic Feedback Loops and Continuous Iteration

Utilizing the Platform for Real-Time Curriculum Iteration:

The true educative value of the custom e-learning platform lies in its architecture as a "living" ecosystem rather than a static archive. Because the ICT teachers in fragile contexts are positioned as co-designers and Trainers of Trainers (ToTs), their ongoing classroom experiences are critical to the evolution of the OERs. The platform integrates dynamic feedback loops, allowing teachers to submit real-time data from the field—such as newly discovered AI hallucination patterns, successful localized prompts, or emerging classroom needs.

For instance, as teachers use the AI tools to manage severe curriculum compression in Accelerated Education Programmes (AEP), they log their experiences via structured reflection templates and error-pattern logs. This qualitative feedback is routed back to the platform administrators and university partners (Makerere and Muni University). The curriculum developers then continuously iterate and update the OER materials, refining the prompt libraries and adjusting ethical guidelines to reflect current technological advancements and evolving classroom realities. This feedback mechanism transforms the platform into an active Community of Practice, ensuring that the training materials remain highly relevant, contextually grounded, and continuously improved by the very educators who use them.

[Insert Link to the Custom E-Learning Platform Here] [https://rgai.educaifutures.com/]

7.1 Statistical Baseline: Systemic Precarity and Epistemic Vulnerability

7.1.1 The Ground-Truth Realities of In-Service Refugee Educators: Diagnosing the Pipeline Gap

To deeply understand the systemic friction that necessitated the GAI-ACT project's strategic evolution, it was critical to first analyze the ground-truth baseline data extracted directly from the original target beneficiaries: the **in-service educators operating on the frontlines of Uganda's refugee settlements and Accelerated Education Programmes (AEP)**. Far from theoretical assumptions, this rigorous diagnostic profiling exposed a severe landscape of digital inequity, universal infrastructural precarity, and profound pedagogical isolation that severely restricted the safe adoption of Generative AI. When this stark empirical reality was computed alongside the urgent feedback from high-level stakeholder engagements—which warned that **Teacher Training Institutions (TTIs) were failing to produce "AI-ready" graduates** and that unregulated tech deployment would only exacerbate existing disparities—the consortium recognized that a linear, top-down implementation would inevitably fail. Consequently, this baseline data served as the ultimate empirical anchor, **explaining the project's realistic transition away from merely deploying foreign tools in camps, and grounding the critical strategic pivot upstream to secure the national teacher pipeline at Muni University**. By diagnosing the exact infrastructural limitations, digital divides, and systemic mentoring deficits paralyzing current in-service teachers, the consortium was empowered to engineer a highly tailored, "governance-first" capacity-building ecosystem that transforms pre-service teachers into fully equipped, offline-ready "Master Trainers" *before* they are deployed into these highly fragile educational environments.

The Awareness-to-Adoption Pipeline and Mentoring Deficits:
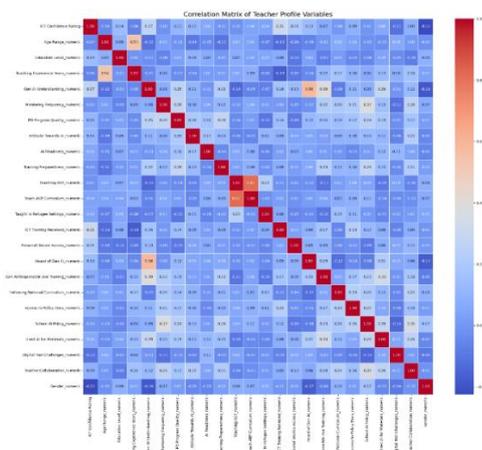
Figure 31.The correlation matrix heatmap providing a comprehensive overview of the linear relationships between various numerical and mapped categorical variables in the generative AI profiles.

The correlation matrix empirically validates the interconnectedness of digital literacy and AI adoption in fragile settings, revealing a clear "Awareness to Adoption Pipeline" where initial AI understanding strongly correlates with practical application in generating teaching materials (r=0.42). More critically, the strongest positive correlation identified was between the frequency of pedagogical mentoring and the perceived quality of professional development (r=0.58). This insight profoundly informed our implementation strategy; it proved that isolated, parachute-style training events fail in refugee contexts. Because in-service teachers lack consistent support, the project engineered the 1:9 Trainer-of-Trainers (ToT) model. By specifically targeting pre-service teachers at Muni University, we are injecting a new generation of highly trained "Master Trainers" directly into the pipeline, ensuring they arrive in fragile classrooms already equipped to serve as the vital mentors that current in-service teachers desperately lack.

Device Precarity and Offline-First Course Design
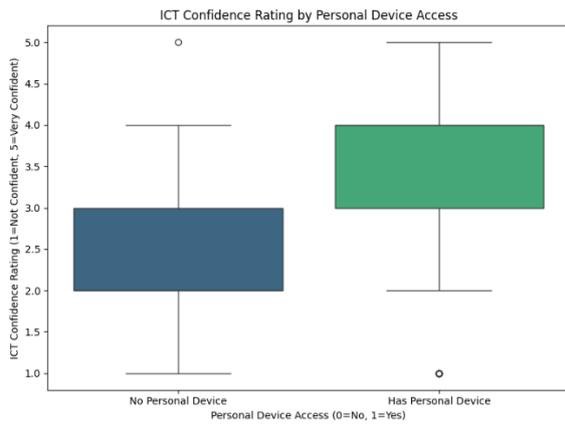
Figure 32.ICT Confidence vs. Personal Device Access Box Plot

Baseline diagnostics exposed a severe digital equity barrier: educators possessing personal digital devices exhibited substantially higher median ICT confidence compared to those without.

In refugee host communities, the lack of personal hardware directly exacerbates the digital divide and paralyses technological confidence. This ground-truth reality dictated the architectural design of the project's scalable deliverables. Knowing that continuous online access is a privilege few AEP teachers possess, the consortium explicitly engineered the custom e-learning platform and the Open Educational Resources (OERs) to be low-bandwidth and fully exportable via portable media like USB drives. For the pre-service teachers at Muni University, this means their training is not theoretical; they are learning to utilize and distribute offline-ready prompt libraries so their pedagogical effectiveness is not compromised when they deploy to schools lacking digital infrastructure.

Validating the TTI Capacity Gap
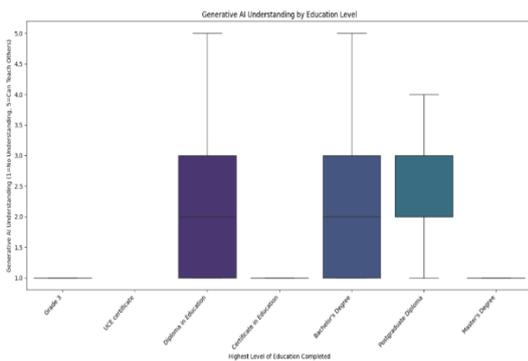
Figure 33.Generative AI Understanding by Education Level Box Plot

This visualization completely validated the stakeholders' urgent warnings regarding the systemic failure of Teacher Training Institutions (TTIs) to produce AI-ready graduates.

The data reveals that formal academic attainment does not guarantee technological literacy; there is massive variability, and even educators holding Bachelor's and Master's degrees frequently exhibited merely basic understandings of Generative AI. This empirical finding provided the undeniable justification for the project's strategic pivot to anchor capacity-building efforts upstream at Muni University. It proved that to achieve long-term scale, we had to intervene before teachers reached the camps. By deploying the Higher Education tracks (GAI-ED-001, 002) to pre-service teachers and university lecturers, the project permanently seals this capacity gap, guaranteeing that future cohorts possess the foundational AI literacy that current veteran teachers lack.

Leveraging Positive Sentiment for Generational Scaling:
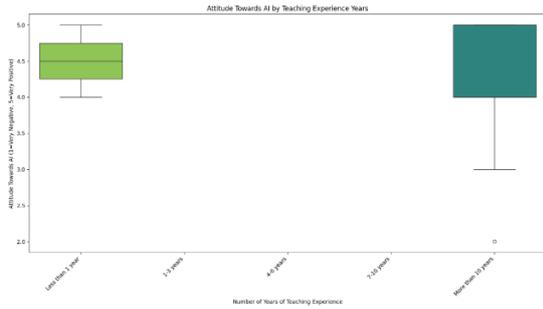
Figure 34. Attitude Towards AI by Teaching Experience Years Box Plot

A critical finding dismantled the assumption that veteran teachers in fragile contexts would resist technological disruption.

The distribution of attitudes towards AI against years of teaching experience revealed consistently positive dispositions across all cohorts, from newly deployed educators to veterans with over ten years of experience. The medians overwhelmingly clustered around "Positive" and "Very positive," proving that the primary barrier to AI adoption is not ideological tech-phobia, but rather a lack of resources and targeted training. For the pre-service teachers graduating from our program, this is a vital scaling enabler: it ensures that when these newly minted, highly tech-literate educators enter refugee-hosting schools, their innovative AI methodologies will be met with receptiveness and collaborative optimism by veteran staff, facilitating organic, peer-to-peer capacity building.

Empirical Justification for Blended ToT Methodologies:
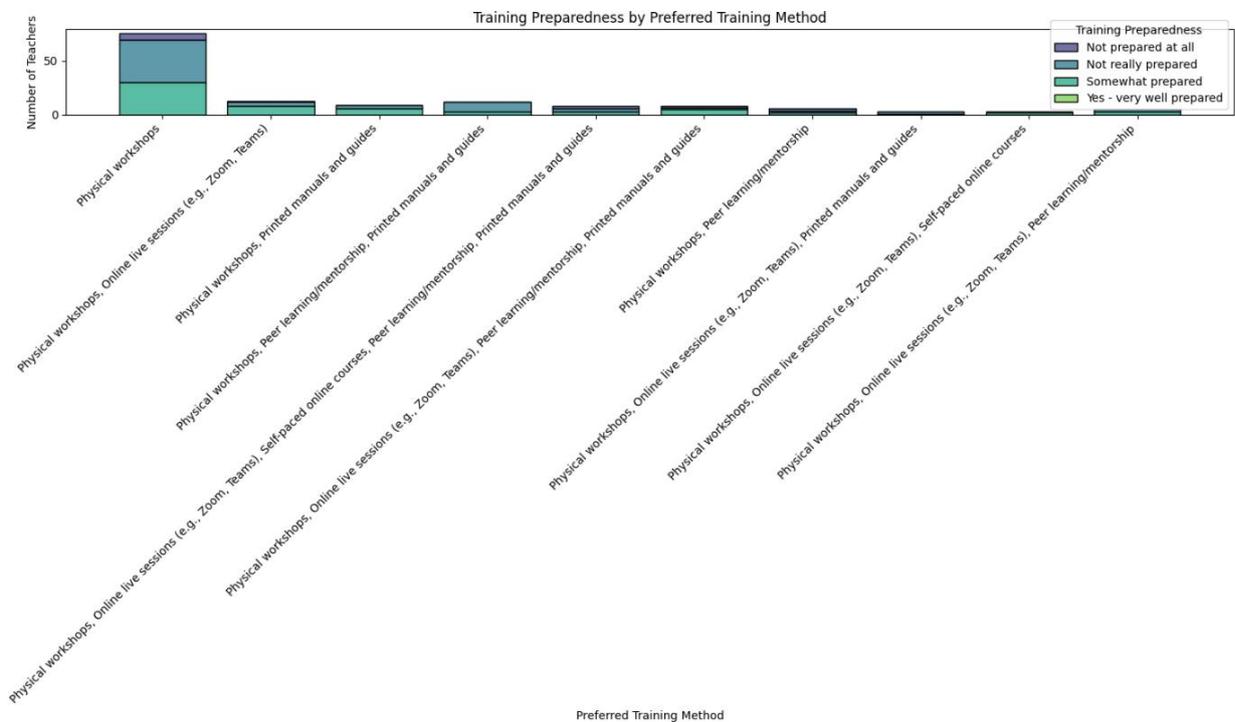
Figure 35.Stacked Bar Chart illustrating Training Preparedness by Preferred Training Method

The structural design of the capacity-building intervention was directly informed by the educators' own pedagogical preferences. Baseline data revealed an overwhelming demand for physical workshops, peer-mentorship, and printed manuals over isolated digital learning. Teachers in resource-constrained environments require direct interaction and collaborative problem-solving to feel prepared. This completely validated our reliance on a localized, physical Trainer-of-Trainers (ToT) model rather than a purely virtual deployment. By training the pre-service educators in physical cohorts at Muni University and providing them with tangible, printed Prompt Engineering Manuals, we are modeling the exact blended pedagogical frameworks they will use to upskill their in-service peers in the refugee settlements.

The Inherent Digital Demand of Accelerated Education (AEP)
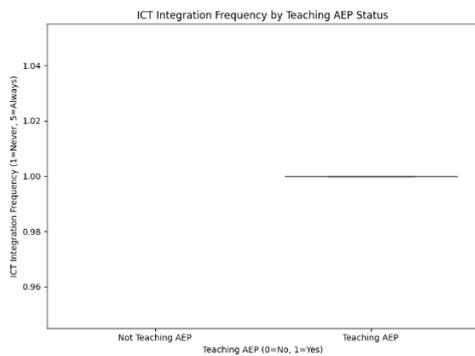
Figure 36. ICT Integration Frequency by Teaching AEP Status Box Plot

The severe pedagogical friction caused by condensing the Competency-Based Curriculum (CBC) into the Accelerated Education Programme (AEP) inherently forces teachers to seek adaptive digital solutions.

Baseline analytics revealed that educators deployed in AEP settings exhibit a higher median frequency of ICT usage compared to their peers in mainstream classrooms. Because AEP teachers must navigate extreme curriculum compression and diverse, over-age learner profiles, they are naturally driven to utilize digital tools. However, without localized AI, this integration was highly susceptible to epistemic bias. This data explicitly directed the course design of the **GAI-AEP-101** module and the sovereign AEP AI Prototype. We are equipping pre-service teachers with specialized tools optimized specifically for curriculum compression and multilingual bridging, directly answering the high-frequency digital demands of the AEP environment.

The Universality of Infrastructural Precarity
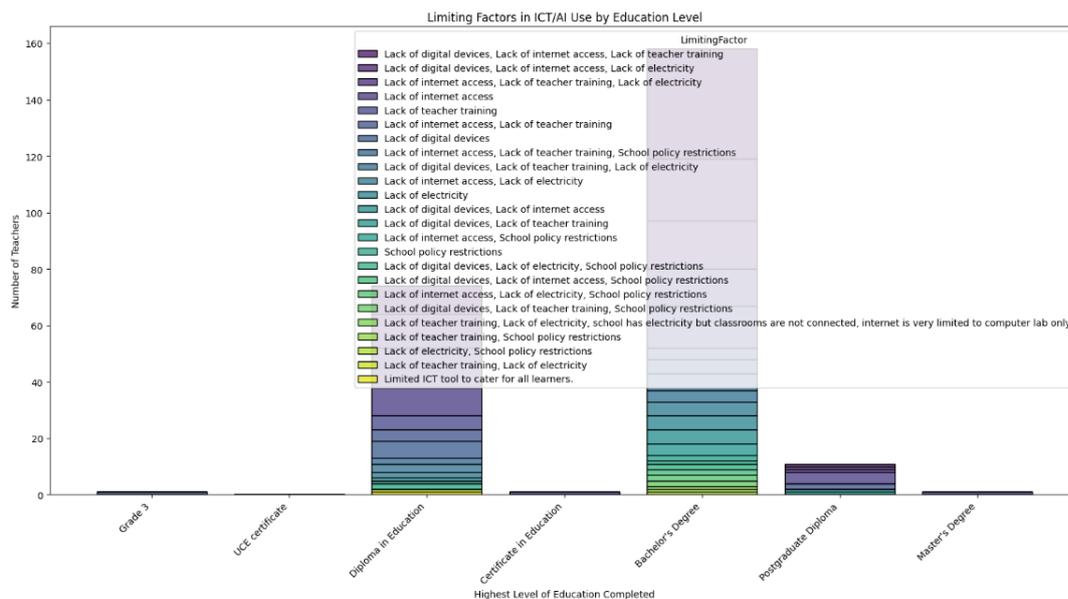
Figure 37.Stacked bar chart illustrating Limiting Factors in ICT/AI Use by Education Level

When evaluating the structural limitations impeding AI adoption, baseline data confirmed that the challenges of the fragile classroom supersede individual academic qualifications. The stacked bar chart demonstrates that severe infrastructural deficits—specifically the lack of digital devices, internet access, and reliable electricity—are the dominant, universal barriers crippling the instructional capacities of both primary certificate holders and Master's graduates alike. This finding heavily influenced the technological implementation and scaling of our AI tools. It proved that any generative AI solutions deployed by our newly trained pre-service teachers had to be exceptionally lightweight and independent of consistent grid power. This led directly to the development of our localized, bias-resistant prototypes, which are engineered to generate high-quality instructional materials offline or in low-bandwidth scenarios, ensuring the technology serves the precarious environment rather than being hindered by it.

Systemic Isolation and the Pre-Service Mentorship Solution
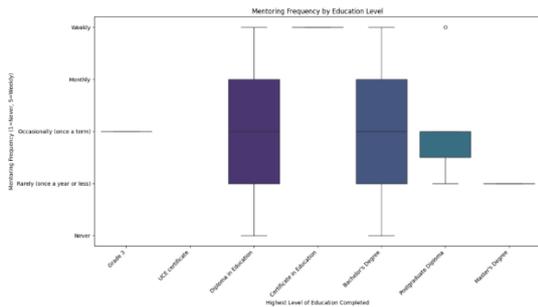
Figure 38.Mentoring Frequency by Education Level Box Plot

For capacity-building to scale organically, it must address the profound isolation experienced by educators in fragile contexts.

The baseline data mapped mentoring frequency against education levels, revealing a systemic deficit in pedagogical support; the vast majority of educators, regardless of their academic background, reported receiving mentoring "Rarely" or "Occasionally". This isolation cripple's continuous professional development. The project circumvented this structural failure by deputizing the pre-service teachers themselves. By transforming the Muni University cohorts into highly trained "Master Trainers," we are actively manufacturing the mentors that the system currently lacks. When these pre-service teachers graduate and deploy, they are not just filling teaching vacancies; they are bringing a self-sustaining peer-support network directly into the schools, capable of continuously upskilling unreached veteran teachers.

The Imperative for "Governance-First" Institutional Safeguarding
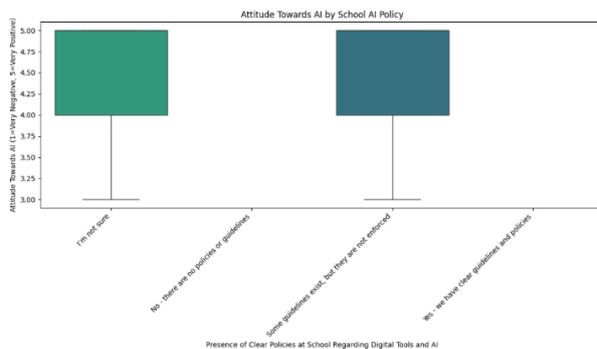
Figure 39. Attitude Towards AI by School AI Policy Box Plot

The strategic pivot to prioritize institutional governance is heavily corroborated by baseline policy data. The analysis revealed that institutional ambiguity breeds pedagogical hesitation; while general attitudes toward AI were positive, schools possessing clear, enforced AI guidelines exhibited a tighter distribution of high confidence among their teaching staff.

Conversely, ambiguous or non-existent policies left teachers uncertain and vulnerable. This definitely proved that deploying AI without securing institutional authorization is reckless. It validates the creation of our governance tracks (GAI-ADM-101) and explicitly informs the training of our pre-service teachers. We are teaching these future educators the principles of trauma-informed boundaries (GAI-TIP-101) and data privacy, ensuring they understand how to advocate for and operate within clear institutional safeguarding policies the moment they enter a fragile school ecosystem.

7.1.2 Stakeholder Informed Target Focus (consideration of Pre-Service Teachers)

The baseline data, captured before the intervention, rigorously profiled the socio-technical realities of in-service educators and pre-service teachers within the Teacher Training Institution (TTI) pipeline. Analyzing the utilization dataset (N=234) and pre-training dataset (N=304), it became evident that the adoption of Generative AI was already occurring, but in a highly unregulated and pedagogically dangerous vacuum.
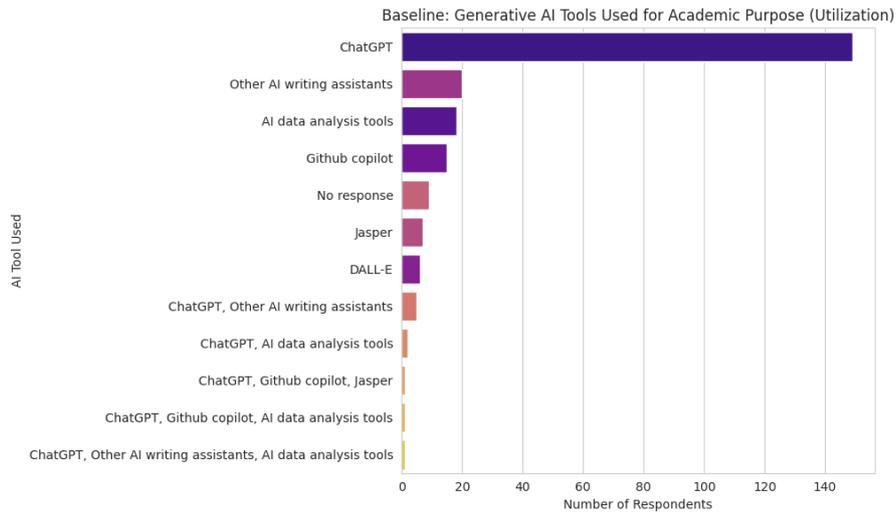
Figure 40. ChatGPT is overwhelmingly the most used generative AI tool for academic purposes, indicating its dominant presence in the academic landscape among respondents.
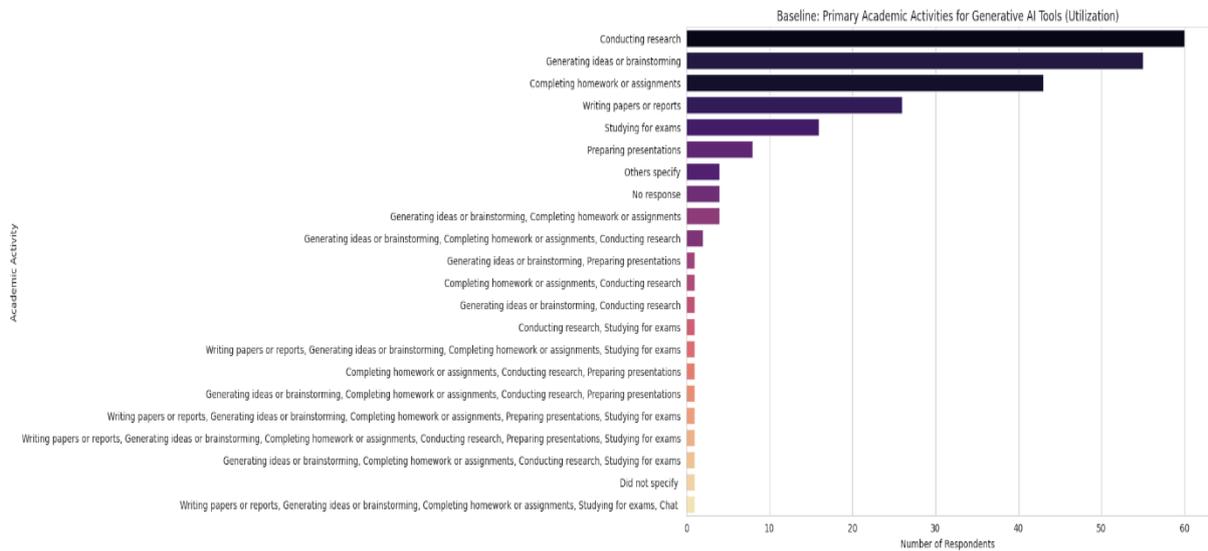
Figure 41. Conducting research, generating ideas, and completing homework are the most common academic activities for which generative AI tools are used, suggesting these are the current high-impact areas for AI integration.
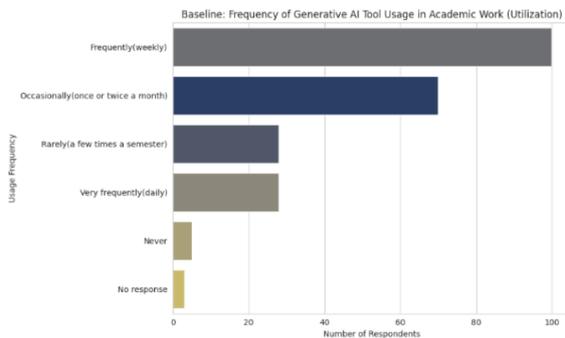
Figure 42. A majority of respondents use generative AI tools frequently ("Often" or "Sometimes"), indicating a widespread existing integration of AI into their academic routines.
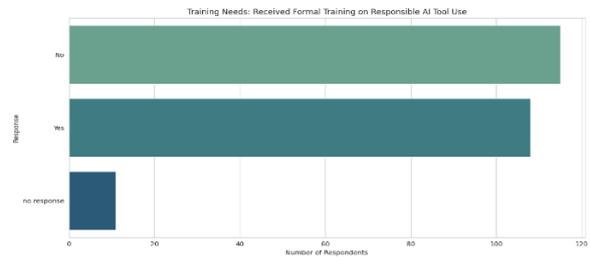
Figure 43. A significant portion of respondents have not received formal training from their university on responsible AI tool use. This highlights a critical training gap that universities need to address to ensure ethical and effective AI integration.
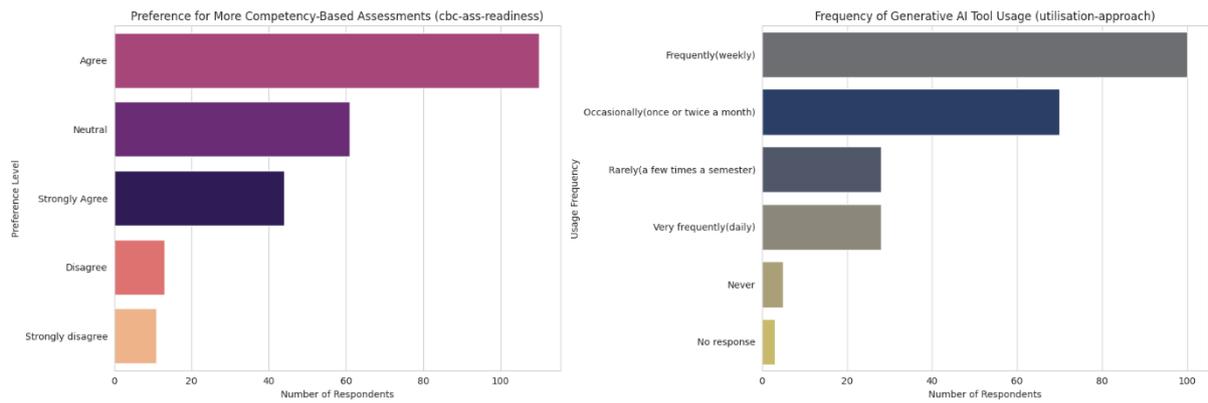
Figure 44. A strong majority of respondents express a preference for more competency-based assessments, aligning with a high frequency of generative AI tool usage (often or sometimes). This suggests that teachers are receptive to integrating innovative assessment

Figure 45. Both analytical results show that a significant portion of respondents have a moderate to positive perception of fairness in CBAs and an average to good understanding of AI ethical implications. This indicates a baseline level of ethical awareness and trust in asse

Prior to any formal training, 63.7% of the surveyed educators were already utilizing generative AI—overwhelmingly ChatGPT—primarily for conducting research, generating ideas, and completing academic assignments. This unregulated usage perfectly illustrates the systemic gap identified by stakeholders during the project's strategic pivots: teachers entering the workforce were adopting complex digital tools without the institutional safeguarding or ethical frameworks necessary to deploy them safely in vulnerable educational settings. By capturing this baseline at Muni University, the data empirically validated the necessity of securing the teacher pipeline before cascading these technologies directly into fragile Accelerated Education Programme (AEP) classrooms.

This unguided adoption posed a profound epistemic risk, particularly when contextualized against the realities of refugee and crisis-affected education. Baseline diagnostics revealed a critical cognitive vulnerability: 17% of these pre-service and in-service educators possessed a "Poor" or "Very poor" ability to critically identify biases or hallucinations within AI-generated content. In a fragile AEP context, educational materials must delicately navigate complex cultural sensitivities, trauma, and diverse local languages. The inability of the teaching workforce to critically audit Western-centric Large Language Models (LLMs) threatened to perpetuate data colonialism, exposing vulnerable learners to factually incorrect or culturally misaligned curricula. If these future educators were deployed into the overcrowded refugee camps without the capacity for speculative epistemic auditing, they would risk functioning as mere conduits for algorithmic bias, thereby exacerbating the epistemic erasure that the GAI-ACT project explicitly sought to dismantle.

Comparative Analysis: Readiness vs. Utilization (Visualisation 3/5)

Preference for More Competency-Based Assessments (cbc-ass-readiness)

Frequency of Generative AI Tool Usage (utilisation-approach)
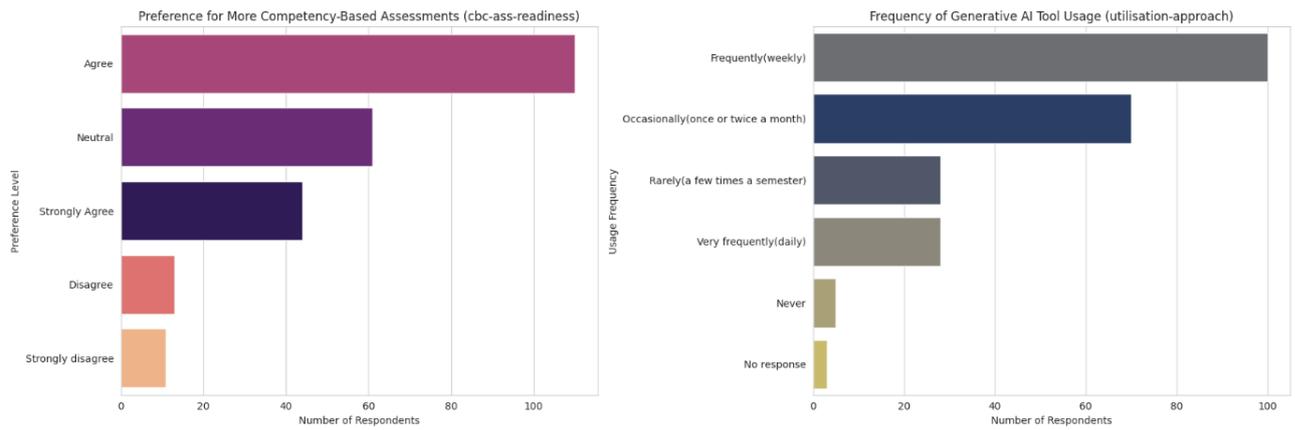
Figure 46. A strong majority of respondents express a preference for more competency-based assessments, aligning with a high frequency of generative AI tool usage (often or sometimes). This suggests that teachers are receptive to integrating innovative assessment

Comparative Analysis: Readiness vs. Utilization (Visualisation 2/5)

Belief in Accuracy of Competency-Based Assessments (cbc-ass-readiness)

Impact of Generative AI Tools on Academic Work Quality (utilisation-approach)
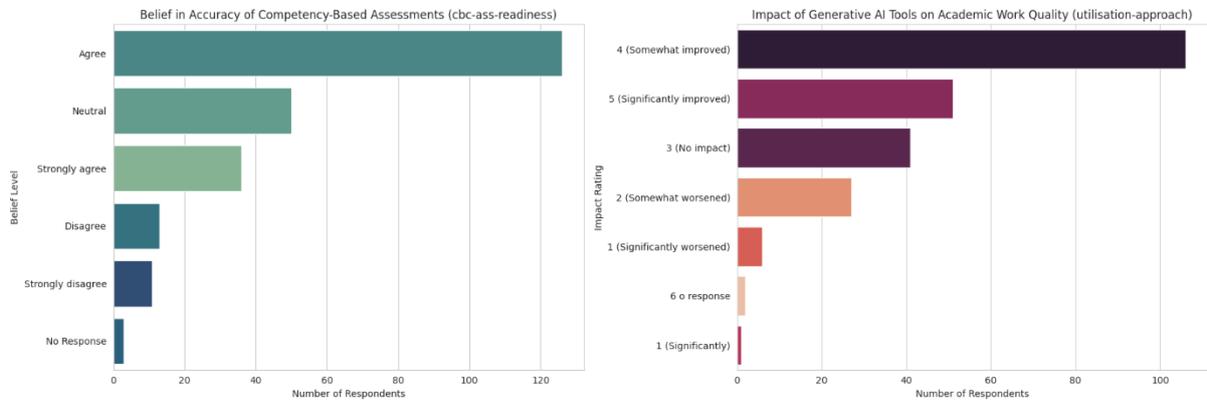
Figure 47. Both analytical results reflect a positive outlook on modern educational tools and methods. A majority believe CBAs are more accurate, and similarly, many respondents perceive generative AI tools as having a positive impact (somewhat or significantly improved)

Comparative Analysis: Readiness vs. Pre-training AI Skills (Visualisation 4/5)

Perception of Fairness of Competency-Based Assessments

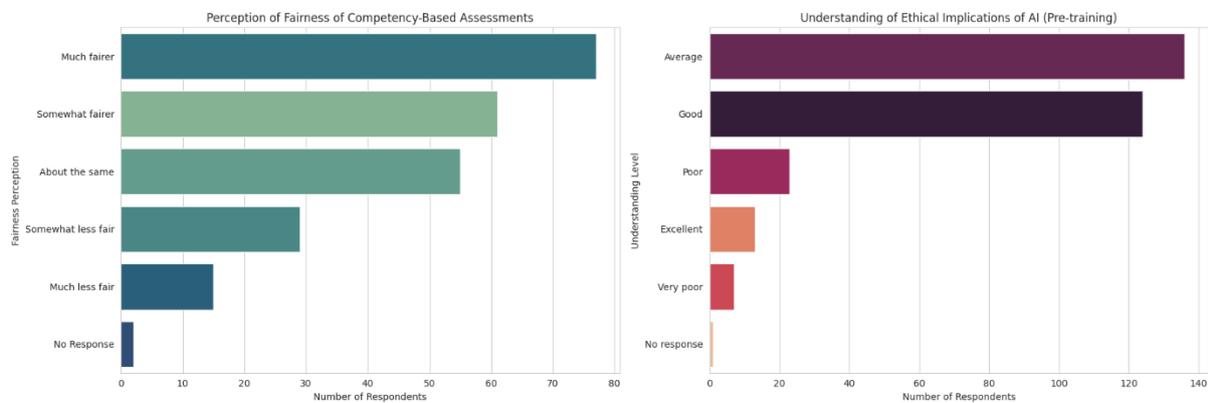Understanding of Ethical Implications of AI (Pre-training)
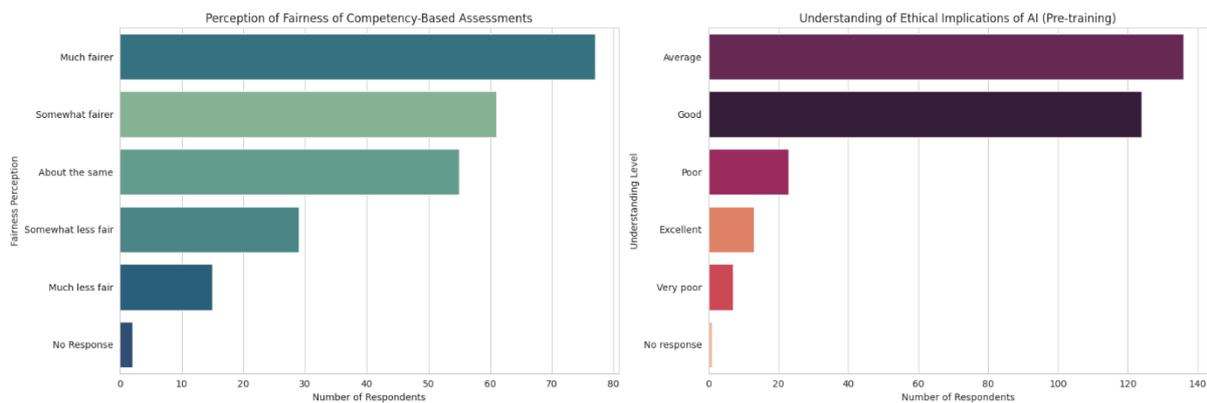
Figure 48. Both analytical results show that a significant portion of respondents have a moderate to positive perception of fairness in CBAs and an average to good understanding of AI ethical implications. This indicates a baseline level of ethical awareness and trust in assessment

Conversely, despite the severe infrastructural constraints and digital precarity defining their operational environments, the readiness profiling (N=239) demonstrated a resounding grassroots

demand for systemic pedagogical reform. The data indicated that educators fundamentally recognized the limitations of traditional, rote-based examinations; a combined 64.4% of respondents explicitly preferred that more of their courses include Competency-Based Assessments (CBAs). Furthermore, they deemed these assessments significantly fairer for diverse learning populations, with 32.2% rating them as "Much fairer" and 25.5% as "Somewhat fairer" compared to traditional exams. This quantitative baseline is crucial; it proves that the educators themselves were conceptually ready and eager for the pedagogical paradigm shift demanded by Uganda's new Competency-Based Curriculum.

The friction was not ideological resistance to the curriculum, but rather a lack of adaptive, scalable tools to execute it effectively. Consequently, this baseline data established the exact thematic mandate for the subsequent AI capacity-building OERs: to bridge the gap between the teachers' high demand for competency-based systems and their urgent need for localized, bias-resistant generative AI tools to deliver them.

Quantitative Shifts in Techno-Pedagogical Competencies (Intervention Efficacy)

The deployment of the Trainer-of-Trainers (ToT) capacity-building program induced profound, statistically significant transformations in the techno-pedagogical competencies of the participants. While the original proposal envisioned targeting only active in-service teachers directly within refugee settlements, rigorous stakeholder engagements revealed a critical systemic gap: Teacher Training Institutions (TTIs) were not producing "AI-ready" graduates, meaning short-term interventions in camps would fail to provide sustainable, long-term change. Consequently, the project strategically pivoted upstream to upskill pre-service teachers (educators in training) and university lecturers at Muni University, effectively securing the pipeline of educators destined for these vulnerable, refugee-hosting regions. To rigorously measure the efficacy of this systemic intervention, Chi-squared tests for independence were conducted, comparing pre- and post-training response distributions. The analyses yielded a p-value of < 0.05 for both the "Understanding of Generative AI" and the "Ability to Identify Biases in AI-Generated Content," confirming a statistically significant cognitive enhancement directly attributable to the training.

Figure 49. The analytical results show a positive shift in AI understanding after training.

While respondents generally had moderate familiarity with AI/ML concepts before using tools, their understanding of generative AI significantly improved post-training, w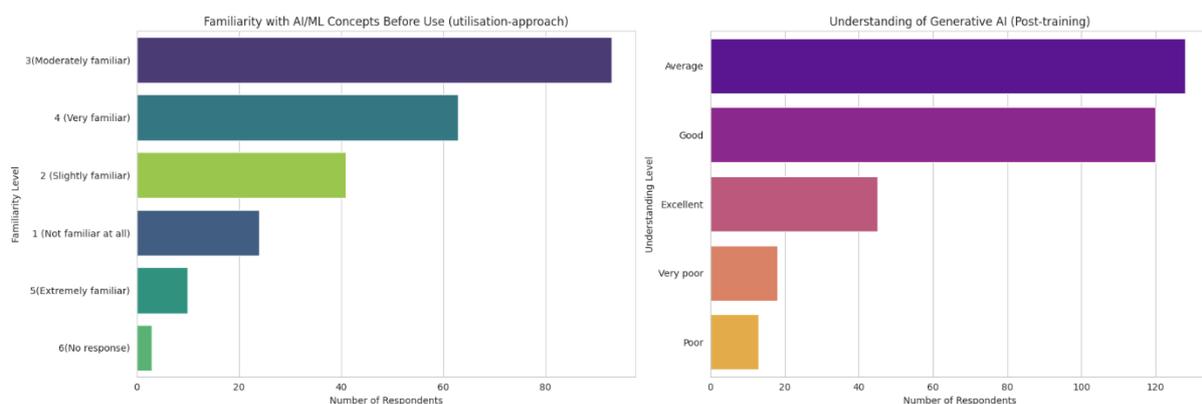ith a higher proportion reporting "Good" and "Excellent" understanding. This suggests the training was effective in enhancing foundational AI knowledge.
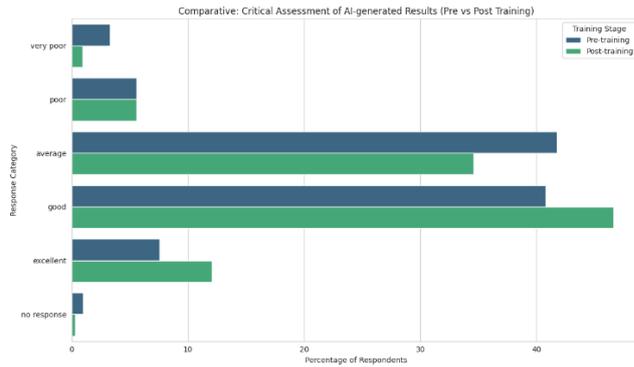
Figure 50. Post-training, there is a clear improvement in the ability to critically assess AI-generated results, with a shift from "Average" to "Good" and "Excellent" ratings, indicating enhanced critical thinking skills. This statistical shift is most critically observed in the pre-service and in-service teachers' newfound mastery of speculative epistemic auditing. Baseline data indicated a dangerous epistemic vulnerability, with a considerable segment of these educators rating their ability to identify algorithmic biases in AI-generated content as "Poor" or "Very poor".

Post-training data indicates a massive reduction in this vulnerability; the percentage of teachers rating their ability to critically identify algorithmic biases as "Good" or "Excellent" surged, systematically collapsing the "Poor" categories. By triangulating this empirical shift with the deployment of the highly specialized GAI-AEP-101 (Generative AI for Accelerated Education Programming) module, it becomes evident that the curriculum successfully shifted these future educators from passive consumers of foreign AI into aggressive, critical auditors. Equipping them with these auditing competencies while they are still in the TTI pipeline guarantees that when they are eventually deployed to fragile, resource-starved AEP classrooms, they arrive possessing the technical sovereignty required to enforce local pedagogical boundaries and protect refugee learners from culturally misaligned, hallucinated content.
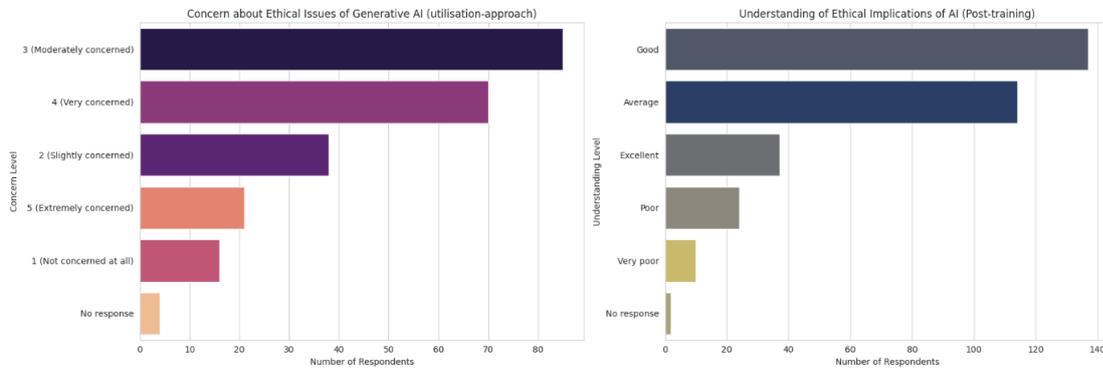
Figure 51. The analytical results show that while there was a significant level of concern about ethical issues related to generative AI before training, the post-training understanding of ethical implications has largely shifted towards "Good" and "Excellent" This suggests the training was effective in not only addressing pre-existing concerns but also in deepening teachers' knowledge and awareness of AI ethics.
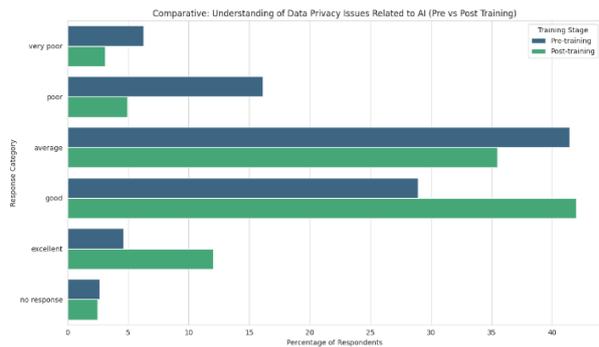
Figure 52. There is a positive shift in the understanding of data privacy issues related to AI, with more respondents reporting "Good" and "Excellent" understanding post-training, indicating improved awareness.

Furthermore, the empirical results robustly validate the project's "governance-first" pivot, demonstrating a dramatic spike in ethical preparedness and institutional safeguarding among the teaching workforce.

Following the targeted training, over 77% of the participating educators felt highly prepared (rating themselves as "Very prepared" or "Moderately prepared") to engage in high-level institutional AI ethics discussions. Concurrently, their confidence in utilizing AI responsibly transitioned predominantly to "Very confident" and "Moderately confident". This heightened ethical readiness maps directly to the successful integration of the GAI-TIP-101 (Trauma-Informed Pedagogy) and GAI-PSS-101 (Psychosocial Support) modules. These tracks rigorously trained the educators to establish clinical "no-go zones," ensuring that AI is never misused for diagnosis or forced trauma disclosure. By embedding these ethical safeguards into the professional foundation of pre-service teachers, the project directly serves its original target audience: guaranteeing that highly vulnerable, conflict-affected learners in refugee camps will be guided by professionals capable of utilizing AI safely to enhance inclusive, trauma-sensitive educational delivery.

Generalizability and Scalability to Unreached In-Service Teachers

A critical metric of success for capacity-building interventions in fragile environments is their ability to organically generalize beyond the initial funding cohort. The empirical findings robustly support the scalability of this model to in-service teachers who have worked in fragile contexts for years but missed out on the direct GAI-ACT training. The baseline profiling data established that educators in low-resource environments survive severe structural deficits by relying heavily on collaborative pedagogical strategies, specifically "group work and peer teaching" and the sharing of self-made resources. By pivoting upstream to train pre-service teachers and university lecturers at Muni University—because Teacher Training Institutions (TTIs) were failing to produce "AI-ready" graduates—the project fortified the very source of the teacher pipeline. Operating on the highly structured 1:9 Trainer-of-Trainers (ToT) cascading model, the initial 612 targeted educators have been transformed into statistically proven "Master Trainers". Endowed with newly acquired, empirically validated confidence in AI utilization and aggressive bias-detection skills, these pre-service teachers are perfectly positioned to act as systemic change agents. Upon their graduation and deployment into the fragile Accelerated Education Programme (AEP) classrooms, they will seamlessly integrate these sovereign competencies into existing, organic peer-mentorship networks, effectively upskilling veteran, unreached in-service teachers through grassroots collaboration.
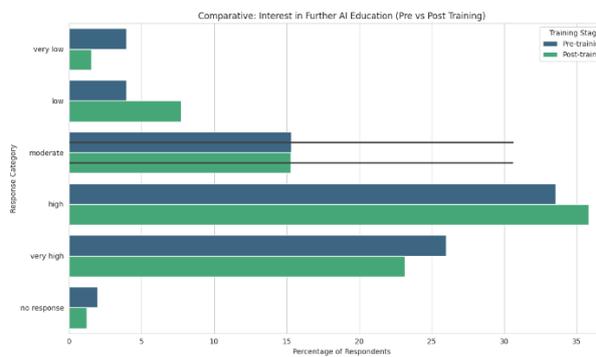
Figure 53. The training has spurred increased interest in further AI education, with a notable shift towards "High" and "Very high" interest post-training, suggesting a desire for continuous learning in AI.
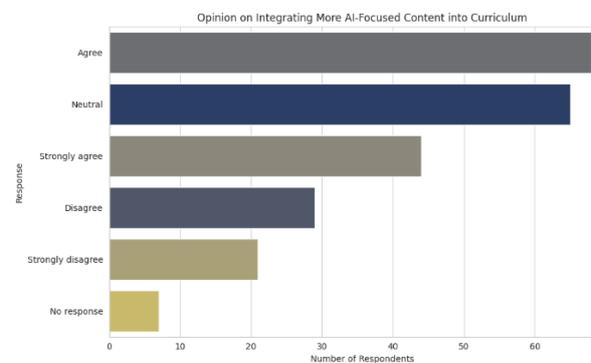
Figure 54. A significant majority of respondents believe their institution should integrate more AI-focused content into the curriculum, underscoring a strong demand for AI education within academic settings.

Furthermore, the scalability of the intervention is permanently secured through asynchronous delivery, directly addressing the infrastructural precarity of the Global South. The post-training empirical data revealed an overwhelming quantitative demand for continuous AI education, with respondents' interest shifting heavily into the "High" and "Very high" tiers following the intervention. Recognizing that unreached teachers in deep-rural refugee settlements lack consistent access to electricity or internet, the consortium abandoned the reliance on live, synchronous workshops. Instead, the entire capacity-building ecosystem was modularized into sovereign Open Educational Resources (OERs), including specific tracks like GAI-PRI-101 and GAI-SEC-101 designed for foundational school teaching. These OERs, alongside the co-created, culturally nuanced Prompt Libraries, were purposefully engineered for low-bandwidth and offline dissemination via portable media. This strategic packaging ensures that the advanced techno-pedagogical training can bypass digital divides and reach the most isolated in-service educators without requiring them to leave their fragile host communities.

Challenges Faced When Using Generative AI Tools (Utilization)
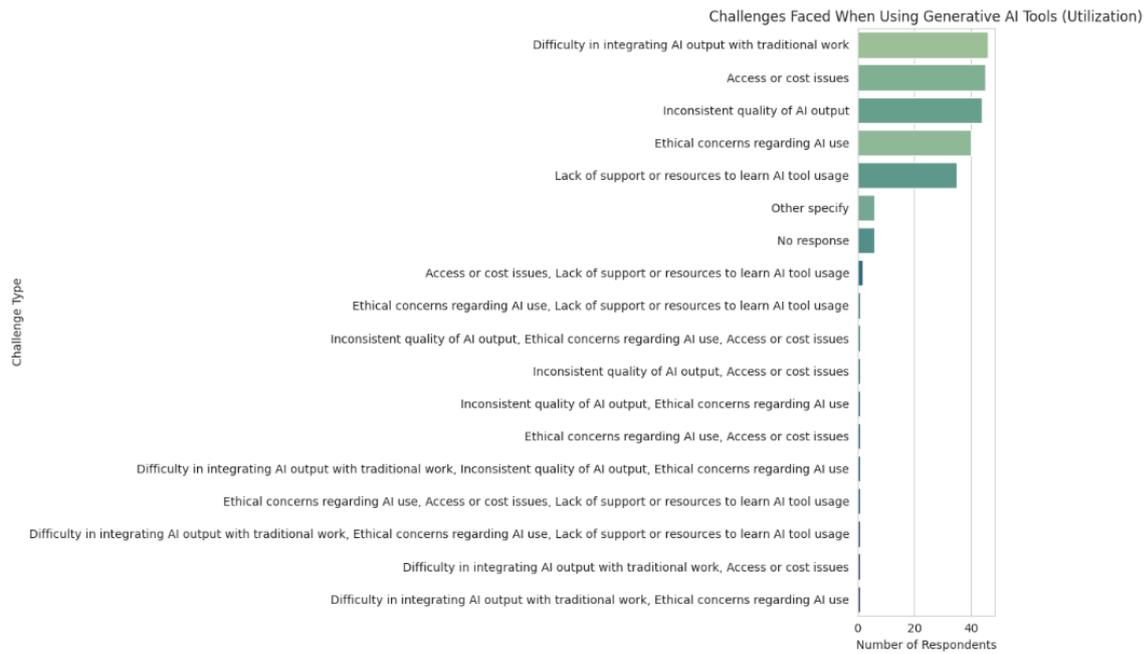
Figure 55. Lack of reliability/accuracy and ethical concerns are the most frequently cited challenges when using generative AI tools, indicating critical areas that training programs should address.
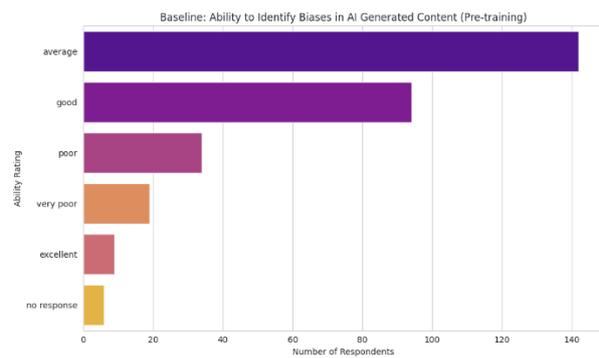
Figure 56. A significant portion of respondents rated their ability to identify biases in AI-generated content as average or good, but there is also a considerable segment with poor or very poor ratings, highlighting a clear area for development.
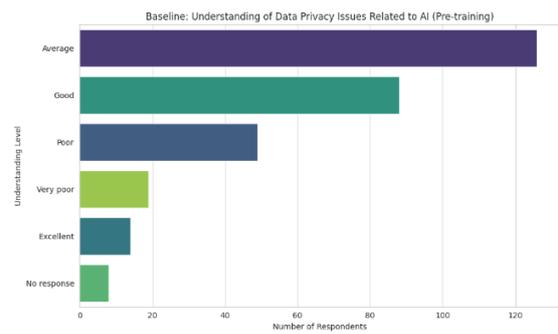
Figure 57. Before training, most respondents had an average or good understanding of data privacy issues related to AI, but a notable portion reported poor or very poor understanding, highlighting an area needing attention.
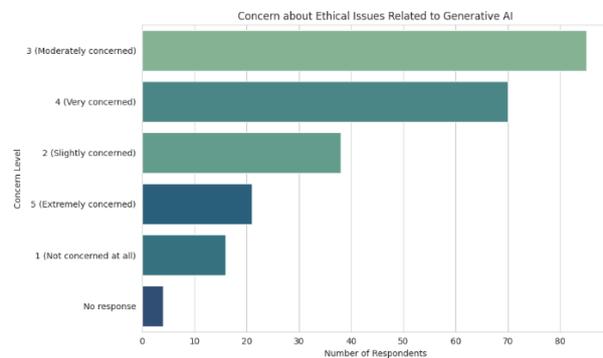
Figure 58. Many respondents expressed high or moderate concern about ethical issues related to using generative AI in their studies, indicating that ethical considerations are a prominent aspect of AI tool utilization.

Ultimately, the data proves that when localized educators are provided with contextually grounded frameworks, their initial institutional resistance completely dissolves into high perceived professional value. Following the introduction of the project's sovereign, localized CBC and AEP Generative AI prototypes—a direct pivot necessitated by the severe hallucination crisis and epistemic erasure caused by foreign LLMs—post-training surveys captured a massive spike in respondents rating the AI training as "Very beneficial" and "Extremely beneficial" to their long-term careers. Unreached educators working in refugee settlements face the exact same structural frictions as the training cohort, namely severe curriculum compression, massive overcrowding, and the need for trauma-informed pedagogy.
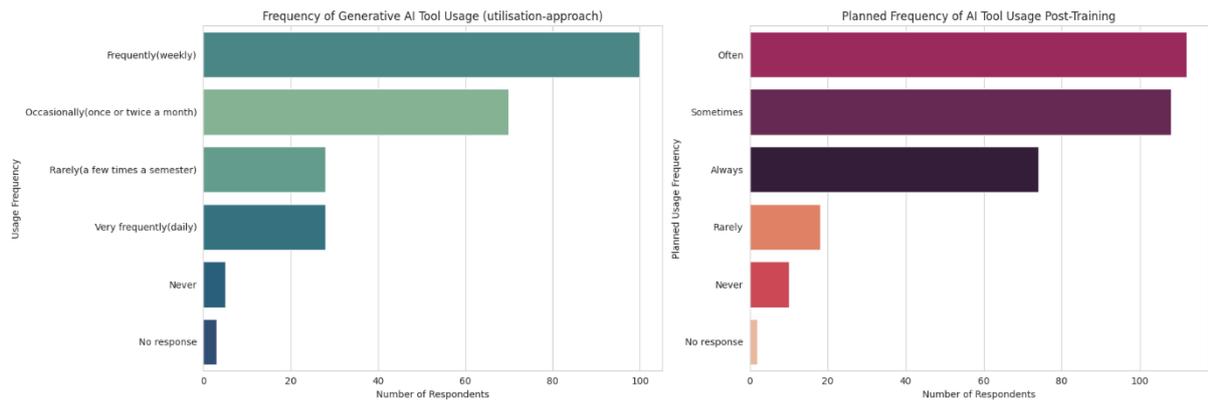
Figure 59. The plots show a notable shift towards more frequent planned usage of AI tools after training. The plots show a notable shift towards more frequent planned usage of AI tools after training.
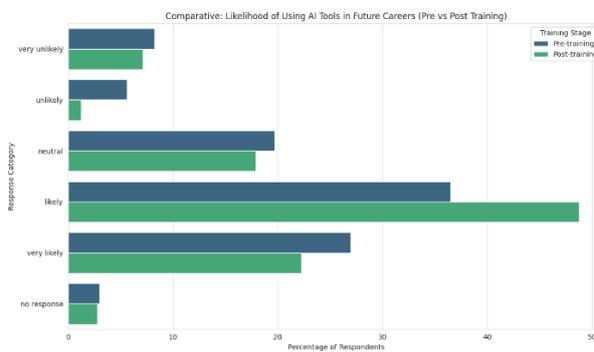
Figure 60. The training has reinforced the likelihood of using AI tools in future careers, with an increase in "Likely" and "Very likely" responses post-training, suggesting increased confidence and perceived relevance.
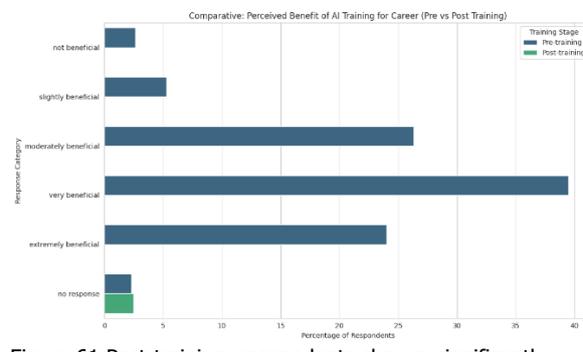
Figure 61.Post-training, respondents show a significantly higher belief that AI training will be beneficial for their careers, with a marked increase in "Very beneficial" and "Extremely beneficial" responses, highlighting the perceived value of the training.

Because the specialized OERs and localized AI tools developed by this project were empirically proven to solve these exact contextual challenges, the ecosystem is immediately generalizable. It stands ready for national scale-up, offering a scientifically grounded, bias-resistant digital infrastructure capable of elevating the pedagogical sovereignty of the entire fragile education sector.

Sustainability, Ethical Governance, and Future Directions

This section proves EdTech stakeholders with the understanding that the initial investment in the GAI-ACT project is not only highly secure and ethically sound but also structurally primed for sustainable, long-term scaling. By anchoring our technological innovations in rigorous legal frameworks and attracting subsequent global funding, the consortium has ensured that this capacity-building ecosystem will outlive the initial funding cycle.

Data Governance and Safeguarding

A critical lesson learned during the strategic pivots of this project was that deploying Generative AI in fragile, refugee-hosting contexts introduces profound risks regarding data extractivism and the privacy of highly vulnerable populations. To operationalize our commitment to educational sovereignty and "do no harm" principles, the project established an ironclad legal and ethical governance architecture.

The Data Sharing Agreement (DSA) Framework: To legally safeguard the personal and professional data of the ICT teachers and the downstream refugee learners they serve, a comprehensive Data Sharing Agreement (effective April 10, 2025) was executed between **War Child Canada** (acting as the Data Provider and custodian of AEP records) and the **GAI4Educ Consortium**

(comprising Makerere University as the Lead Institution, the National Curriculum Development Centre [NCDC], and the University of Edinburgh as the Data Recipient).

This DSA ensures strict compliance with a matrix of stringent international data protection laws, including Uganda's Data Protection and Privacy Act (Cap. 97), the European Union's GDPR, and Canada's PIPEDA.

Technical and Ethical AI Safeguards Implemented: To prevent the very digital colonialism and data exploitation the project sought to critique, the consortium engineered specific AI-related technical safeguards into the project's data processing lifecycle:

- **Data Minimization and Pseudonymization:** Before any local educational data was utilized to train or fine-tune our sovereign AI prototypes (the CBC and AEP models), all direct identifiers were stripped and tokenized. Full anonymization was legally mandated before any AI outputs, research papers, or open-source models could be publicly disseminated.

- **Secure AI Sandbox and Federated Learning:** To protect raw datasets, AI model development was restricted to secure, air-gapped networks equipped with real-time monitoring for anomalous access. Where feasible, federated learning was utilized to process data locally on secure devices, avoiding the centralization of sensitive refugee learning data into vulnerable cloud servers.

- **Bias Mitigation and Transparency Audits:** As mandated by Clause 4.4 of the DSA, the consortium implemented strict bias mitigation protocols to ensure that the generated AI models did not perpetuate historical or systemic discrimination against marginalized refugee groups. To maintain epistemic integrity, the project conducted and documented continuous transparency audits tracking data lineage and algorithmic decision-making processes, which are submitted as annual ethics reports validated by an independent AI ethics board.

- **Strict Human Oversight:** Institutional accountability was protected through a "No Fully Automated Decisions" clause. The project ensured that AI outputs affecting individuals (such as teacher evaluations or critical curriculum guidance) could not be deployed without review and validation by qualified human personnel.

Scaling the GAI-FCT Model

The rigorous, participatory, and ethically bounded approach taken by the GAI4Educ consortium yielded preliminary findings that were so robust, they quickly attracted external validation. The consortium is profoundly grateful to announce that based on our initial success with the CODE grant, the project was awarded the prestigious **Google Academic Research Award**. This vital extra support from Google has been instrumental in rapidly scaling the project's artifacts—including the continuous hosting of our custom e-learning platform and the localized CBC/AEP AI prototypes—as well as facilitating the broad dissemination of our research outputs to a global audience.

Figure 62. Dissemination of Findings from the Research at a Decolonization Conference

Figure 63. Television panel discussion about out lessons learned on Systematic integration of AI support tools in Education Contexts

With this expanded capacity, the consortium offers the following evidence-based recommendations for policymakers, donors, and educational stakeholders seeking to utilize this localized, participatory AI model to support formal and Accelerated Education Programmes (AEP) across other fragile contexts in Sub-Saharan Africa:

1. Adopt a "Governance and Capacity-First" Deployment Strategy: Donors and policymakers must abandon the "tech-solutionism" model of simply dropping foreign AI tools (like raw ChatGPT or Gemini) into fragile classrooms. Funding must first be directed toward institutional capacity building. By replicating our ToT (Trainer of Trainers) cascading model and establishing local "Generative AI Champions" within Teacher Training Institutions (like our partnership with Muni University), stakeholders can ensure that technology is regulated and contextualized by local experts *before* it reaches the classroom.

2. Invest in Sovereign AI Infrastructure and Modular OERs: To prevent epistemic erasure and long-term financial dependency on Global North tech monopolies, future educational investments in Sub-Saharan Africa should prioritize the co-creation of localized, open-source AI models and datasets. The Open Educational Resources (OERs) developed in this project were deliberately designed as modular toolkits. We recommend that Ministries of Education across the region adapt these modular OERs, translating their prompt libraries and pedagogical frameworks to fit their own local languages, cultural markers, and national competency-based curricula.

3. Center Participatory Co-Design for Epistemic Pluralism: Educational technology interventions must transition teachers from passive end-users into active co-designers. We recommend scaling our "Speculative Epistemic Auditing" methodology, which empowers grassroots educators to interrogate AI tools for Western biases and hallucination errors, adapting the technology to fit the infrastructural constraints (e.g., offline functionality, low-bandwidth access) of their specific rural or refugee-hosting realities.

4. Bridge the Policy-to-Delivery Gap in Crisis Contexts: As demonstrated by the successful handover of our AI prototype to Uganda's NCDC, local AI tools must be integrated directly into formal government educational structures. We recommend that international aid organizations and NGOs (e.g., UNHCR, UNICEF) use this project's blueprint to align their emergency education funding with host-nation curriculum policies, utilizing localized AI to seamlessly bridge the gap between emergency accelerated learning (AEP) and mainstream formal schooling or Technical and Vocational Education and Training (TVET) pathways.

5. Expand the Cascading Trainer-of-Trainers (ToT) Architecture: To achieve rapid, cost-effective scale without sacrificing contextual nuance, future interventions should adopt the project's proven 1:9 ToT cascading ratio. By identifying and upskilling local ICT teachers as "Master

Trainers," these educators can mentor their peers within their respective refugee camps and host communities. Scaling this model ensures that AI training is delivered by trusted community members who deeply understand the local pedagogical friction, rather than relying on external consultants who may lack context.

6. Leverage Low-Bandwidth and Offline Dissemination Strategies: Scaling digital initiatives in the Global South often fails when it assumes reliable internet connectivity. To democratize access across remote refugee settlements, educational stakeholders must ensure that AI instructional materials and Open Educational Resources (OERs) are packaged for offline environments. We recommend scaling the distribution of our custom e-learning platform and curriculum via portable media (such as USB flash drives) to ensure equitable access for teachers operating in schools lacking consistent power or broadband.

7. Cultivate Digital Communities of Practice (CoP) and Open Prompt Libraries: Sustainable scaling relies on horizontal, peer-to-peer knowledge sharing. As the project expands, donors should fund the facilitation of teacher-led Communities of Practice utilizing low-bandwidth platforms like WhatsApp or Telegram. Within these hubs, teachers can collaboratively troubleshoot AI hallucinations, share successful localized prompts, and co-curate dynamic, open-source repositories like a "Prompt Library v2". This organic scaling mechanism ensures that AI tools continuously evolve through grassroots pedagogical insights.

8. Institutionalize "AI-Readiness" in Pre-Service Teacher Training: Scaling a temporary intervention into a permanent systemic upgrade requires shifting focus upstream to Teacher Training Institutions (TTIs). Taking cues from our strategic partnership with Muni University, national education ministries should mandate the integration of our Higher Education tracks (GAI-ED-001, GAI-ED-002, GAI-ED-003) into university curricula. Training university lecturers to co-design AI coursework ensures that the next generation of graduate teachers enters fragile and mainstream classrooms already equipped with robust, responsible generative AI competencies.

9. Champion Open-Source Digital Public Goods for Sovereign AI: To prevent digital colonialism, tools developed for fragile contexts must remain free from commercial paywalls and proprietary enclosures. We strongly recommend that any localized AI models—such as the CBC and AEP generative AI prototypes developed by this consortium—be deployed and scaled as open-source, non-commercial tools for public benefit. By maintaining open-source access, other Sub-Saharan nations can safely audit, adapt, and fine-tune these models to align with their own national syllabi and cultural contexts without being tethered to foreign tech monopolies.

10. Facilitate High-Level Policy Translation and Regional Integration: Finally, grassroots AI innovations must be formally recognized at the governance level to achieve true scale. The consortium recommends utilizing project findings, empirical data, and policy briefs to actively engage with national education sector meetings and regional bodies, such as the East African Community (EAC). Furthermore, collaborating with global education coalitions and humanitarian agencies (e.g., UNHCR, UNICEF, the World Bank, and the Mastercard Foundation) will help translate our localized AI methodologies into broader, standardized guidelines for emergency and accelerated education responses globally.
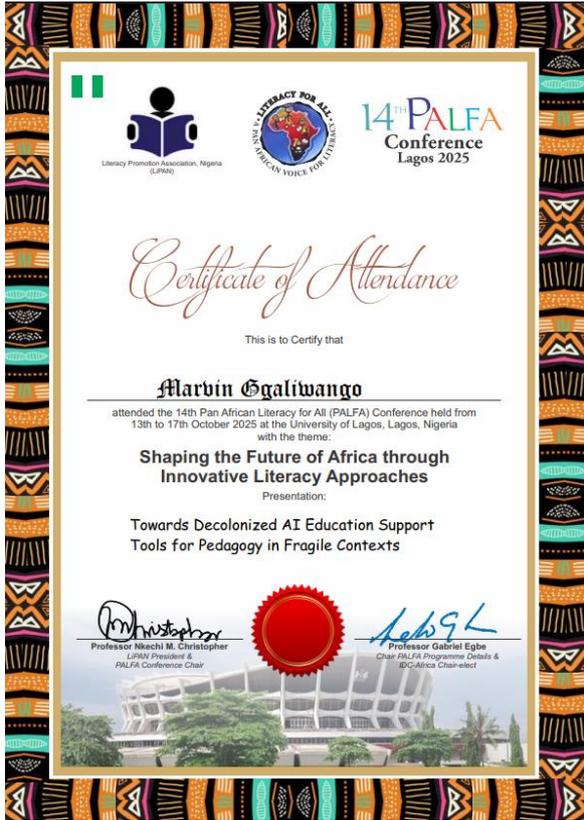
Figure 64. Conference presentation about decolonised AI Education Support tools for Pedagogy in Fragile Contexts
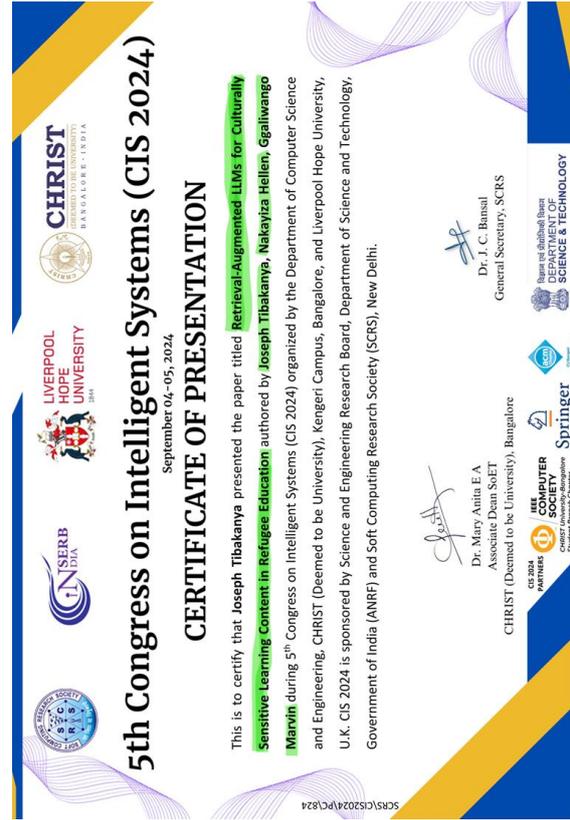

Figure 65. Conference paper Dissemination about lessons learning during prompt Engineering with AEP teachers

Bibliography

1. Bayne, S., & Gallagher, M. (2021). Near Future Teaching: Practice, policy and digital education futures. Policy Futures in Education, 19(5), 607–625. https://doi.org/10.1177/14782103211026446

2. Hayes, S., Earle, S., Dukhan, S., Padayachee, K., Dison, L., Milaras, M., Smit-Stachowski, A., Aharonson, V., Hoosen, N., Luo, M., Hewlett, L., Badenhorst, C., Andrews, D., Osman, R., Weaich, M., Dube, S., Genga, R., Tam, C., Prinsloo, P., … Nartey, E. (2025). Perspectives from South Africa on GenAI in higher education: A postdigital dialogue with the global context. Postdigital Science and Education, 7(4), 1375–1413. https://doi.org/10.1007/s42438-025-00593-6

3. Hellen, N., & Marvin, G. (2023). Learning analytics for cloud-based education planning. 2023 7th International Conference on Trends in Electronics and Informatics (ICOEI), 717–723.

4. Hellen, N., Marvin, G., Balikuddembe, J. K., & Tulinayo, F. P. (2024). Strategic utilization of ChatGPT in teaching and learning. In Lecture Notes in Networks and Systems (pp. 129–139). Springer Nature Singapore.

5. Joseph, T., Hellen, N., & Marvin, G. (2025). Retrieval-augmented LLMs for culturally sensitive learning content in refugee education. In Lecture Notes in Networks and Systems (pp. 425–442). Springer Nature Singapore.

6. Joseph, T., Maria, N., Moses, T., & Marvin, G. (2026). Beyond hype: Will Ugandan educators continue using large language models for learning content creation? IEEE Access: Practical Innovations, Open Solutions, PP(99), 1–1. https://doi.org/10.1109/access.2026.3675523

7. Marvin, G., Hellen, N., Jjingo, D., & Nakatumba-Nabende, J. (2024). Prompt engineering in large language models. In Algorithms for Intelligent Systems (pp. 387–402). Springer Nature Singapore.

8. Marvin, G., Tamale, M., Kanagwa, B., & Jjingo, D. (2023). Philosophical review of artificial intelligence for society 5.0. In Algorithms for Intelligent Systems (pp. 1–15). Springer Nature Singapore.

9. Reynolds, A., Gallagher, M., Russell, I., Horner, L. K., Austin, S., & Cole, G. (2025, October 29). Achieving 15% enrolment of refugees in higher education: Evidence review and contextual analysis from seven countries. University of Edinburgh Research Explorer; United Nations High Commissioner for Refugees. https://www.research.ed.ac.uk/en/publications/achieving-15-enrolment-of-refugees-in-higher-education-evidence-r/

10. Joseph, T., & Keneth, M. H. (2024). Exploring the synergy of grammar-aware prompt engineering and formal methods for mitigating hallucinations in LLMs. East African Journal of Information Technology, 7(1), 188–201. https://doi.org/10.37284/eajit.7.1.2111

Appendices

DATA SHARING AGREEMENT

Between War Child Canada (Data Provider) and the Generative Artificial Intelligence GAI4Educ Consortium (Data Recipient)

SECTION 1: PARTIES AND BACKGROUND

THIS DATA SHARING AGREEMENT (the "Agreement") is made as of **April 10, 2025** (the "**Effective Date**"):

BETWEEN:

WAR CHILD CANADA, a registered international charity organisation under the laws Canada, with its principal office in Canada at 1586 Bank Street, Ottawa, Ontario K1H 7 and its Uganda office at Plot 21 Bukoto Crescent, Naguru, Kampala, Uganda (the "**D Provider**").

AND

GAI-EDUCATION IN FRAGILE CONTEXTS (GAI4Educ), a consortium compris the following independent entities collaborating on educational research in fragile conte (collectively, the "**Data Recipient**"):

1. **National Curriculum Development Centre (NCDC)**, a statutory body establish under Section 5 of the Education Act (Cap. 128, Laws of Uganda), with offices Kyambogo Hill, Kampala, Uganda.

2. **Makerere University**, a public university established under the Universities and Ot Tertiary Institutions Act of Uganda (2001), with its principal office at Plot 116-1 Pool Road, Kampala, Uganda.

3. **the University of Edinburgh** is an ancient university incorporated by Royal Char (RC000532) in Scotland, with its principal office at Old College, South Brid Edinburgh EH8 9YL, United Kingdom.

The Data Recipient is a collaborative consortium of independent institutions and does constitute a separate legal entity.

SECTION 2: RECITALS

WHEREAS:

A. The **Data Provider (War Child Canada)** is the custodian of **Data** (as defined in Clause 3.1) relating to ICT teachers participating in the Accelerated Education Programme (AEP and AEP ICT host schoolteachers in Uganda.

- **Accessibility**: Open-source non-commercial tools for public benefit.

5. Compliance & Reporting

Obligations:

- Submit biannual progress reports to the Data Provider, including:
  - Research milestones.
  - Workshop participation metrics.
  - AI tool development status.
- Annual ethics review by an independent board.

Alignment with Agreement:

- All activities under this Schedule must comply with:
  - Data protection obligations (Clauses 5.1–5.4).
  - Restrictions on commercial use (Clause 4.2).

Signed for Incorporation into the Data Sharing Agreement:

FOR THE DATA PROVIDER (WAR CHILD CANADA):
Signature: _____
Name: Albert Sibinju
Title: Country Director, Uganda
Date: 13 MAY 2025

FOR THE NATIONAL CURRICULUM DEVELOPMENT CENTRE):
Signature: _____
Name: Tibakanya Joseph
Title: Curriculum Specialist
Date: 13/05/2025

FOR THE DATA RECIPIENT (GAI4Educ CONSORTIUM):
Makerere University (as Lead Institution)
Signature: _____
Name: Ggaliwango Marvin
Title: Technical Lead, GAI4Educ Consortium | Faculty, Makerere University
Date: 13/May/2025