# AI IN EDUCATION - ABUSENSEBOD

EASY STEM SL

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EASY STEM SL
FREETOWN, SIERRA LEONE

## 1. EXECUTIVE SUMMARY

Artificial Intelligence holds great promise to revolutionize the way students learn. Prestigious institutions such as Harvard are already leveraging Artificial Intelligence in teaching while leading EdTech companies like Khan Academy have integrated AI to enhance student learning.

In Sierra Leone, the education system faces challenges such as a shortage of trained and qualified teachers in specific areas, limited access to 21st-century knowledge, and barriers in explaining complex concepts to students, especially those in remote areas with limited English proficiency.

Addressing these challenges, we introduce AbuSensebod, an all-in-one educational platform. Central to AbuSensebod is "Tichalemplemp," an AI teacher who facilitates personalized learning, simplifying even the most intricate subject materials. Uniquely, AbuSensebod supports local languages through its English-to-local language converter.

Furthermore, AbuSensebod emphasizes mentorship, integrating both human and AI-driven mentors that provide guidance to students and the inclusion of online communities for students and learners to learn from each other, foster research, and provide support in their studies. It's equipped to provide early intervention by recognizing students at risk of underachievement. Significantly, AbuSensebod's reach extends beyond the 29% of Sierra Leoneans with internet access.

With the incorporation of the Easy STEM server, it's fully accessible even in the most secluded villages, ensuring inclusivity. Moreover, with our commitment to open data and innovation, we will provide insights into students' learning patterns that are available to stakeholders and researchers, fostering data-driven decision-making to elevate educational outcomes.

Traditional pedagogical methods, both in higher and basic education, may not resonate with every student, given their diverse backgrounds and needs. The integration of AI in education, as demonstrated by AbuSensebod, heralds a new era of adaptive learning. By offering alternative teaching approaches and bolstering foundational education, AI addresses each student's unique needs, paving the way for a more inclusive, tailored, and efficient learning experience. This will make the most advanced of education, mentorship, and understanding accessible to someone in the most remote area in Africa.

## 2. SCIENTIFIC BACKGROUND

Artificial Intelligence (AI) in education has emerged as a significant research domain, offering transformative potential to reshape educational techniques and enrich learning experiences. Key industry players, such as IBM Watson, integrate AI to analyze learning patterns and customize content for students, aligning it with workforce development (Amanda, 2023). Ed tech leader, Khan Academy, has delved into AI with its innovative tool, khanmigo, designed to revolutionize teaching and learning (Khan Academy, 2023).

In Sierra Leone, AI's introduction promises to accelerate the goals of the National Development Plan. Our AI-driven solution aligns with the plan's Cluster 1, focusing on Human Capital Development, by enhancing education quality across all levels and fostering student research. It also resonates with Cluster 3, emphasizing Infrastructure and economic competitiveness, particularly in the realm of information and communications technology. Furthermore, the solution addresses the digital divide, aiming to serve the 72% of Sierra Leoneans lacking internet access.

Delving deeper, AI-driven personalized learning stands out. AI's ability to discern students' learning behaviors enables tailored educational content delivery, improving engagement and retention. Studies, including Pane et al. (2015), validate this approach. Additionally, as e-learning's global footprint expands, there's a crucial demand for platforms that support multilingual users, including local languages. Cummins (2000) emphasizes the importance of native language instruction for effective learning outcomes.

AI's impact is also evident in Early Intervention Systems. Predictive AI algorithms anticipate academic trajectories, including dropout risks. Through detailed student behavior and performance analysis, AI tools pinpoint at-risk students, facilitating timely interventions, as supported by Xie et al. (2018). In today's digital education era, there's an increasing emphasis on Open Data in Education. Promoting open access to educational datasets nurtures collaborative academic discourse, making discussions more comprehensive, a perspective supported by Molloy's 2011 research.

**Advantages of proposed research.**

- Centralized Research Platform: Enables effective collaboration among secondary and tertiary students in communities.
- Tailored for Local Needs: AbuSensebod, specific to Sierra Leone, addresses unique local requirements.
- Local Language Integration: Features an English-to-local language converter for diverse linguistic groups.

- Holistic Educational Approach: Combines AI human mentorship, aligning with holistic educational principles.
- Digital Inclusivity: Easy STEM server extends reach beyond internet-dependent areas.
- Open Data Commitment: Public API aligns with global collaborative research, positioning Sierra Leone at the forefront of AI-driven education.

## 2. GOALS AND SPECIFIC OBJECTIVES

**Overall Goal:**

To leverage the capabilities of AI in addressing Sierra Leone's unique educational challenges, enhancing the quality, accessibility, and inclusivity of education, and fostering a comprehensive and adaptive learning experience

**Research Objectives:**

1. Diagnose Challenges: Quantify Sierra Leone's unique educational hurdles for policymakers and institutions.
2. AbuSensebod Development: Design, refine, and evaluate AbuSensebod for secondary and tertiary students.

3. AI-Enhanced Learning: Explore AI's potential for adaptive and inclusive education.

4. Mentorship Impact: Assess the combined influence of human expertise and AI-driven mentorship within educational platforms.

5. Community-Based Learning: Examine the impact of fostering cohesive learning communities on platforms like AbuSensebod.

6. Open Data Advocacy: Explore integrating open data principles in AbuSensebod, emphasizing relevance to Sierra Leone's education.

**Significance, Importance, and Innovation**

By leveraging Artificial Intelligence, it will revolutionize how students learn, matching global standards set by prestigious institutions and leading EdTech companies.

- Global Educational Standards: AbuSensebod, leveraging AI, revolutionizes learning to match global benchmarks.
- Introduction of "Tichalemplemp," an AI teacher: Novel personalized learning for complex subjects.
- Local Language Support: Recognizes and converts between English and local languages like Krio.
- Hybrid Mentorship and Research Community: Combines AI insight with crucial human interaction.
- Beyond Internet Access: Easy STEM server ensures reach to remote villages beyond the 29% with Internet access.
- Open Data Commitment: AbuSensebod serves as both an educational platform and a valuable data source.

**Potential Benefits:**

1. Inclusive Learning: Ensures students of all backgrounds, especially from remote areas or with limited English, access quality education.
2. Enhanced Outcomes: Personalized learning, early interventions, and mentorship foster superior results.
3. Data-Driven Choices: Insights into student behaviors empower stakeholders to refine education strategies.
4. AbuSensebod emphasizes cultural preservation and enhances learning comfort.
5. Expanded Reach: AbuSensebod bridges the digital divide, catering to students even without the internet.
6. Global Standards: Aligns Sierra Leone's education with international benchmarks.

## 4. PROJECT METHODOLOGY/ APPROACH

**Framework:**

**Operates within Innovation Systems Theory, viewing education as vital for national innovation.**

**User Involvement:**

The private sector has actively contributed to AbuSensebod’s design and will stay engaged through consultations, feedback loops, and testing.

**Software Development Methodology:**

Agile methodology guides iterative software development, prioritizing user feedback.

**AI Model Development:**

Three ML models language translator, AI mentors, and "Tichalemplemp" the AI teacher, developed iteratively with data collection, engineering, building, training, and validation phases.
Continuous refinement based on user feedback.

**Data Collection:**

- Data for educational challenges will be collected via surveys, interviews, and focus groups.
- AbuSensebod's evolution is informed by in-app feedback forms, external surveys, and direct sessions.
- AI learning is enhanced using usage stats, performance metrics, and interaction logs.
- Mentorship and community learning will be tracked through engagement, mentor interactions, and forum logs.
- Open data advocacy will be monitored via API usage, data requests, and contributions.
- Ethical standards maintained with informed consent and data anonymization.

**Data Analysis:**

- Quantitative analysis executed using tools like SPSS, pandas, and Matplotlib for in-depth data insights.
- Qualitative analysis of interviews and survey responses conducted using NVivo for thematic insights.
- Data secured with encryption, limited access to authorized personnel, and stored in secure cloud solutions like AWS S3.
- Data sharing follows our open-data commitment, offering selected datas via API and sharing anonymized data with researchers.
- Data archived on platforms such as Zenodo for long-term preservation.

## 5. ANTICIPATED OUTPUTS AND OUTCOMES

Anticipated Outputs:

- Publications: Research paper on the integration of AI in Sierra Leone's education.
- Policy Brief: Summarize with key insights for policymakers in other to inform educational decisions for students in Sierra Leone
- Technological Platforms: The AbuSensebod platform, is tailored for Sierra Leone's needs.

- Protocols: Documentation on data collection, model training, and deployment.

Anticipated Outcomes:

- Teaching Methodology Evolution: Adoption of a platform may lead to modernized teaching methods.
- Engagement Boost: Students might show increased motivation and better performance.
- Policy Reorientation: Potential shift towards tech-driven education approaches nationally.
- Strengthened Collaborations: Enhanced partnerships between educators, tech providers, and policymakers.
- Community Participation: Increased educational involvement from parents and the community.
- Policy Influence: The project could guide national educational strategies in Sierra Leone and influence regional education policies in neighboring countries.
- Engagement Strategy: Student Workshops, Stakeholder Workshops, Policy Brief Sessions

## 6. DISSEMINATION PLAN

**Findings Sharing:** Through policy briefs, workshops, and digital platforms.
**Policy Influence:** Engaging policymakers and educators for research-based educational strategies.
**Target Audience:** Students in secondary and Tertiary Education.
**Media Involvement:** Using mass and social media campaigns for outreach and platform feedback.
**Open Access**: Strongly supporting open access, ensuring research accessibility for collaboration and transparency.
**Rationale:** A multifaceted approach ensures engagement with various stakeholders, tailoring communication for maximum impact.

## 7. PROJECT GOVERNANCE

Steering Committee:

The steering committee will ensure the project alignment with objective and timeline adherence. It will be made up of Academic, industry, and policy experts from various universities across the world and institutions across Africa. The Directorate of Science, Technology, and Innovation (DSTI) the leading technology institution in the country will be providing technical guidance to the overall project.

**Research Team**

- Principal Investigator – Assiatu Jalloh (MSc. Data Science – University of East London, MPhil. Energy Studies – Fourah Bay College (USL), BSc. Mechanical and Maintenance Engineering – Fourah Bay College (USL))

- Co-Investigator & Operations Lead - Lovetta Bangura (BSc. Civil Engineering)
- Co-Investigator & Machine Learning Lead – Abdul Rahim Jalloh (BSc. Electrical and Electronics Engineering)
- Co-Investigator & Research Lead – Senesi Mansaray (MPhil. Energy Studies, BSc. Agricultural Engineering)
- Team Member & Developer - Iyeba Alpha Kallon (BSc. Electrical and Electronics Engineering – Ongoing)
- Co-Investigator, Developer and Developer Advocate - Ma Zombo Front End Engineer (BSc. Software Engineering)
- Co-Investigator & Development Lead - Emmanuel Kamanda (Bsc. Electrical and Electronics Engineering)

**Partnerships**

Strong collaboration has been established with the Directorate of Science, Technology, and Innovation (DSTI). They have developers and technical experts that can provide technical guidance to the project. They have developed systems used millions of times across the country. As the office of the president is mainly setup for innovation, they open a large network to education experts, but most importantly policymakers in education across the country. Fourah Bay College (USL) is also a key partner, and this will be beneficial in terms of setting up and executing a monitoring and evaluation framework for the project. The University also has the University Innovation Pod at the Fourah Bay College which can provide useful technical equipment and human support when it comes to the work at hand. We are currently setting up meetings with the Ministry of Education in the Country, and other private sector players in education in the country such as TP-education.

Private Sector & Beneficiary Involvement

The private sector and stakeholders will be engaged in prototype testing, feedback, and pivotal roles in refinement. This will enable easy adoption of the technology. Beneficiaries will also participate in pilot programs, workshops, and focus groups

## 8. HOST SUITABILITY:

Easy STEM, a dynamic group of young researchers and innovators, is an ideal host for the project. Their track record in addressing challenges nationwide demonstrates a commitment to solving problems and designing inclusive solutions. With experience in partnership projects (UNICEF, Directorate of Science, Technology and Innovation), a diverse advisory team across the world, and a network of student researchers across Africa, Easy STEM brings valuable expertise to ensure the project's success. The Fourah Bay College (USL) and the Directorate of Science, Technology, and Innovation (DSTI) which has developed educational products such as the result checker used millions of times by Sierra Leoneans will be a strong support pillar to Easy STEM also during the project.

## 9. CAPACITY BUILDING OVERVIEW

**Msc. Students:** Hands-on research opportunities in platform development, data collection, model development, and outreach.

**Undergrad Students**: Active involvement to cultivate a research culture early on.

**Training Workshops:** Organized for students on platform usage.

**Webinars**: Providing insights into the latest advancements in AI-driven education.

## 10. MONITORING AND EVALUATION STRATEGY

- Baseline Study: Pre-project assessment to understand the current educational landscape and AL's potential role.
- Regular Reviews: Quarterly assessment to track progress against objectives.
- Feedback Loops: Continuous stakeholder feedback for prompt issue resolution.
- Outcome Evaluation: Thorough assessment post-project to measure impact against anticipated outcomes.
- Data-Driven Monitoring: Define KPIs and employ analytics tools for continuous project metrics analysis.

## **11**. GENDER, ETHICS AND SUSTAINABILITY

In terms of Ethics, all collected data will be anonymized. AbuSensebod will integrate with ongoing institutional projects, capitalizing on insights from preceding research. To guarantee AbuSensebod's sustained impact, we will be employing a subscription-based business model. Also, we are collaborating

with Government Bodies (as we have done for DSTI) and we will be seeking more as well as various educational institutions who we can partner with for their students to have access to the system. Key risks encompass potential data security breaches, which will be mitigated using encryption and regular security assessments; resistance to the platform, where we'll employ workshops for user familiarization; and potential technical issues, addressed by a dedicated support team. The project is not building on another project but will incorporate parts of another project which is the easy stem server project to ensure that the system works in remote areas. The easy stem server project was sponsored by UNICEF SL and Generation Unlimited to provide students in remote areas access to educational materials. All the proposed activities are new. We are taking full steps to ensure that the team is gender inclusive, we are having female developers and operations lead in the team who are very good at what they do. We will also actively ensure that females get to benefit from the system and will be the first consideration for all focus groups and testing.

**12. WORKPLAN**

| Project Activities | Year 1 | | | | Year 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | QI | Q2 | Q3 | Q4 |
| Project Initiation | X | | | | | | | |
| Conduct surveys and interviews | X | X | | | | | | |
| Building of the AbuSensebod Prototype | X | X | | | | | | |
| Develop AI Models | X | X | X | | | | | |
| Analyze Diagnostics Data | | X | X | | | | | |
| AI Model Training | | X | X | X | | | | |
| Draft Report | | | | X | | | | |
| Finalize Prototype | | | | X | | | | |
| Complete initial AI Models | | | | X | | | | |
| Pilot AbuSensebod | | | | | X | X | | |
| Gather Pilot feedback | | | | | X | X | | |
| Refine AI models | | | | | X | | | |
| Analyze Pilot Data | | | | | | X | X | |
| Workshops to share insights | | | | | | X | | |
| Evaluate Outcomes | | | | | | | X | X |
| Deploy and launch AbuSensebod | | | | | | | | X |
| Publish Research | | | | | | | | X |

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|---|---|---|---|---|---|---|---|---|
| Policy Briefings | | | | | | | | X |

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