

Daniel Sogbey

📍 Accra, Ghana

✉ sogbeydaniel28@gmail.com

🌐 [Website](#)

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Research Interests

AI-supported learning systems that protect and strengthen students' reasoning, with emphasis on mathematics and physics education, teacher learning and conceptual understanding.

My research focuses on how AI can support learning without weakening students' own thinking. As AI tools become easier to use for instant answers, I am interested in designing systems that guide students through reasoning, explanation, revision and problem solving rather than simply providing solutions.

My current work grew out of an AI-guided tutoring system for electric circuits, where I studied how step-by-step guidance can support conceptual understanding. I am especially interested in how similar approaches can support mathematics education, teacher learning, content knowledge, pedagogical content knowledge and mathematical creativity.

Education

University of Cape Coast, Ghana Bachelor of Education in Science (Physics Major), First Class Honours
(GPA: 3.6/4.0) Nov 2022

My undergraduate training combined rigorous study in physics with a strong foundation in mathematics, pedagogy, curriculum design and science education research. My coursework and field experience emphasized pedagogical content knowledge, instructional design and the development of effective teaching strategies for complex scientific and mathematical concepts.

Publications and Scholarly Work

Sogbey, D. (2026). *AI-Guided Scaffolding for Conceptual Understanding in Electric Circuits: A Controlled Pilot Study* . **Preprint**.

Designed and conducted a controlled experimental study evaluating a structured, step-based tutoring system for physics education. Developed a mobile system that enforces sequential reasoning rather than answer delivery. Analyzed pre/post-test data (n=10), observing over 2× improvement in learning gains compared to traditional approaches.

Sogbey, D. (2025). *Integrating Engineering Design to Enhance Conceptual Understanding in Ghanaian Senior High and Technical Education* . **Study (Preprint)**.

Examines engineering design as an instructional approach for improving conceptual understanding. Focuses on inquiry, iterative problem solving and implementation challenges in real classroom settings.

Sogbey, D. (2025). *IoT-Based Energy Monitoring and Adaptive Load Control: A Proof of Concept Using ESP8266 and Simulated Devices* . **Systems Study (Preprint)**.

Designed and implemented an IoT-based system for real-time monitoring and adaptive control, demonstrating integration of embedded systems and data-driven decision-making.

Research Systems

Learner Interaction Logging Pipeline: Designed and used in the *AI-Guided Scaffolding for Conceptual Understanding in Electric Circuits* pilot study. Captured student prompts, AI responses, timestamps, attempts and session activity so the study could examine not only score gains, but also how students reasoned, persisted and revised their thinking during AI-guided problem solving.

Structured Reasoning Tutor: Used in the same *AI-Guided Scaffolding for Conceptual Understanding in Electric Circuits*, this mobile application AI tutoring system guides learners through step-by-step reasoning instead of giving direct answers. The system asks leading questions, prompts students to explain relationships and supports conceptual understanding through guided practice (Flutter, Go backend, Large Language Models).

Circuit Simulation Environment: Interactive web-based system where learners construct circuits, make predictions, run simulations and compare expected and observed outcomes. Designed to study how prediction, feedback and representation support conceptual understanding and misconception correction (JavaScript, event-driven architecture).

Teaching Experience

Teaching Assistant, University of Cape Coast Nov 2022 – Aug 2023
Supported undergraduate instruction in physics education courses. Led tutorials focused on conceptual understanding, pedagogical content knowledge and problem solving and contributed to assessment and feedback.

Mathematics Tutor (Field Experience), Ziope SHS Oct – Nov 2021
Taught core mathematics topics including algebra, trigonometry, logarithms and geometry using interactive, student-centered approaches to improve engagement and problem-solving skills.

Physics Tutor, Express Remedial College Jun – Aug 2019
Prepared students for WAEC examinations, focusing on electricity and electronics concepts and helping learners reason through quantitative and conceptual problems.

Professional Experience

Mobile Product Engineer, Hubtel Ltd Sep 2023 – Present
Design and develop real-time, interaction-driven systems that adapt to user behavior and operational context in high-frequency environments.

- Designed an adaptive location-tracking system with dynamic update intervals based on rider velocity and network conditions, reducing battery consumption by 40% while maintaining real-time accuracy.
- Architected a multi-channel notification system (WebSockets, Firebase Cloud Messaging, API polling) for real-time order dispatch, increasing rider order acceptance rates by 35%.
- Built a multimodal feedback system (voice and image capture) integrated with backend services, improving issue reporting quality by 60% and reducing resolution time by 30%.

This work informs my research interest in adaptive learning systems, particularly how real-time interaction data can be used to guide feedback, personalize support and study how users reason in dynamic environments.

Research-Related Technical Skills

Research Methods: Quantitative and qualitative methods, mixed-methods design, experimental design, pre/post-test evaluation, classroom observation, interview and reflection analysis

Learning Analytics and Data: Interaction logging, student response data, session logs, usage patterns, learning data pipelines, analysis-ready datasets

Educational Technology: AI-supported learning systems, intelligent tutoring interfaces, educational app design, classroom technology integration, learning-tool evaluation

Learning Design: Inquiry-based learning, conceptual assessment, design-based approaches, guided reasoning, scaffolding, feedback design

Tools: LaTeX, GitHub, ResearchGate

Technical Skills

Programming: Python, SQL (PostgreSQL), Go, Dart

AI Systems: Large Language Models (LLMs) integration, prompt design for structured reasoning, evaluation of interactive systems

Backend Systems: REST APIs, database design, real-time data systems

Frontend/Mobile: Flutter, JavaScript, interactive system design

Leadership and Activities

Organized student engagement initiatives through Campus Crusade for Christ International. Participated in team-based activities including competitive football.

Test Scores

GRE Total: 325

164 Verbal, 161 Quantitative, 3.5 AWA