

On Building a Sustainable Research Software and HPC Training Pipeline in West Africa

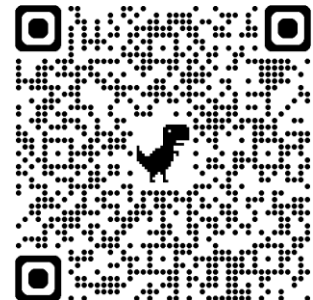
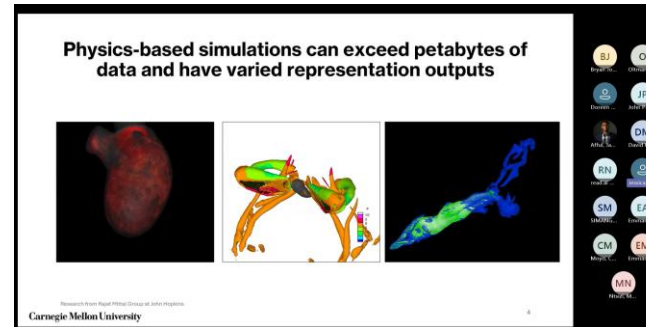
James Afful

Iowa State University

Center for Computational Research and Education (CCRE)

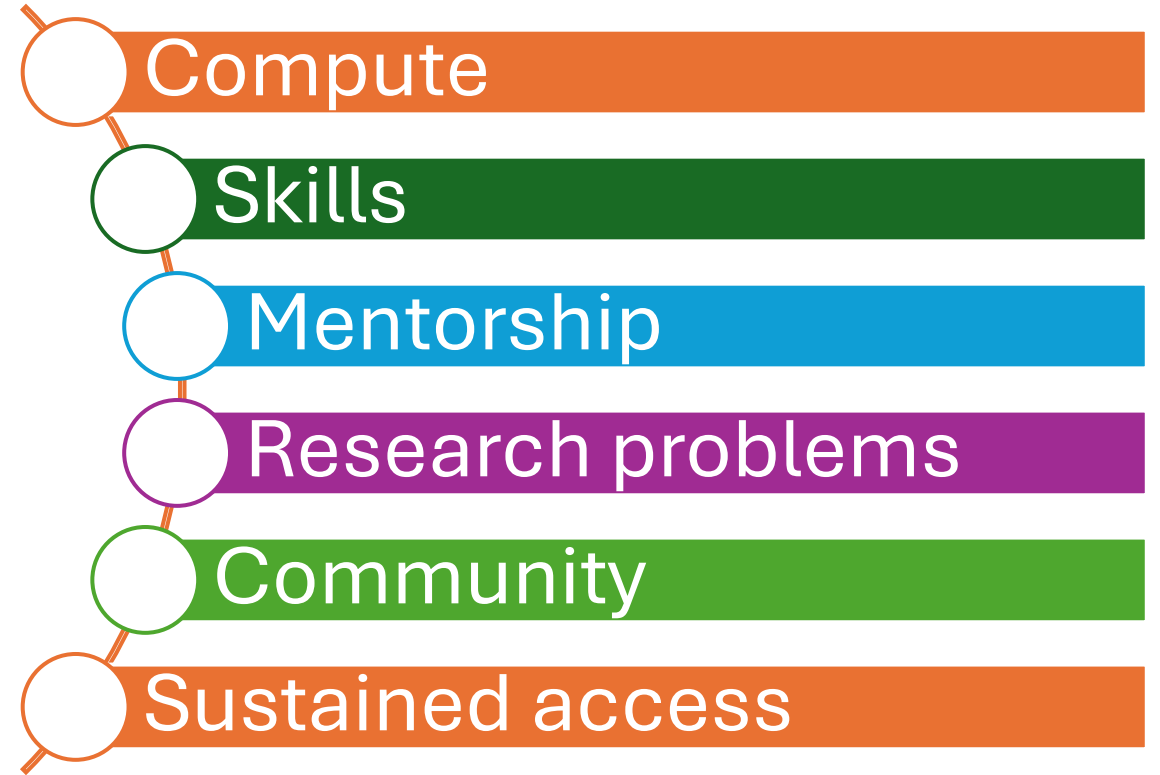
RSAfrica26 [27 August 2026]

Dr. Titus Nyarko Nde (Boise State University)
Onyeka Onyenemezu (Iowa State University)
Dr. Brian Kyanjo (Georgia Tech)
Dr. Benjamin Atribawuni Asaaga (KNUST)
Prof. Joseph Oppong Akowuah (KNUST)
Doreen Anyeley Afful (CCRE)



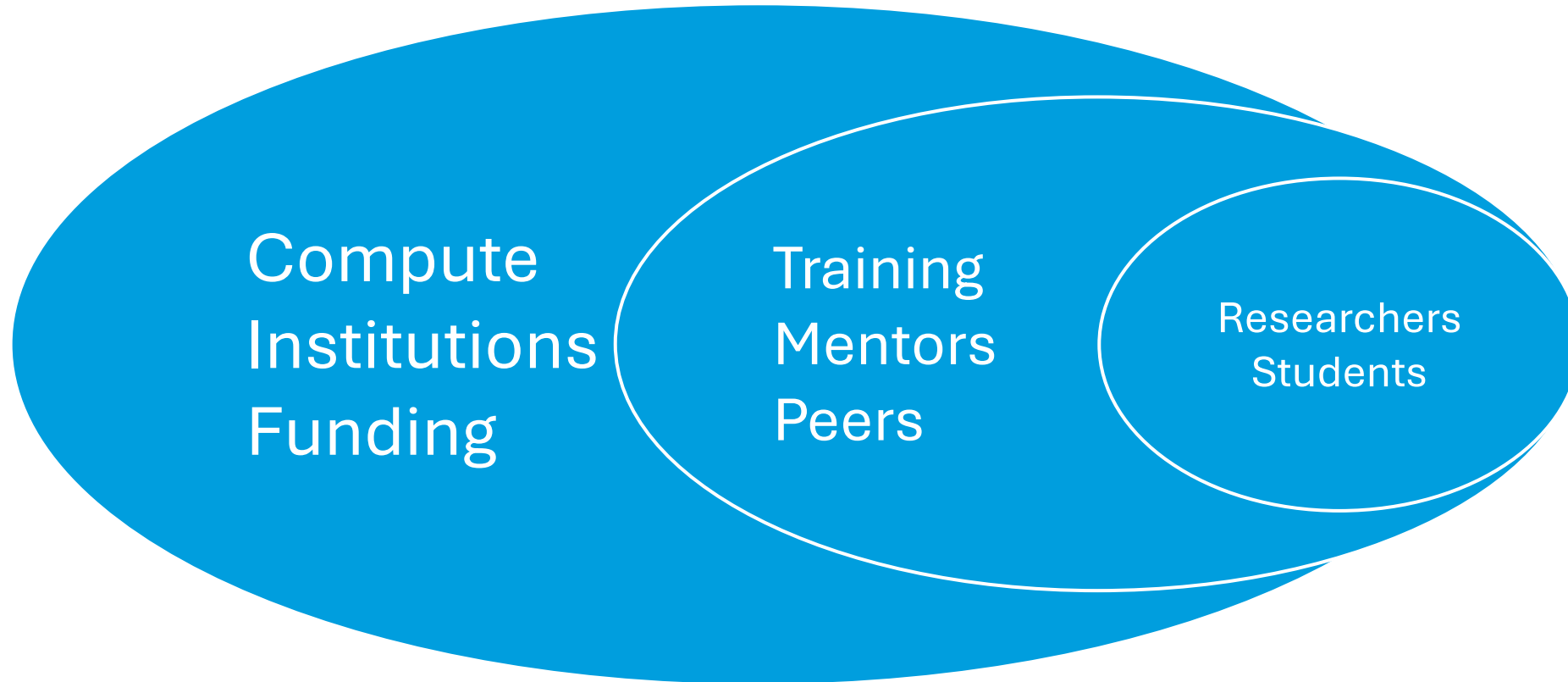
Clusters vs Computational Capacity

- ✓ Modern research increasingly requires computational expertise
- ✓ Extensive efforts are being made to examine the most optimum educational pipelines
- ✓ [Raj et al. 2020] discuss curricular and pedagogical challenges in HPC education
- ✓ [Ponce et al. 2019] document increasing demand and breadth in scientific-computing training
- ✓ [Chakravorty et al. 2020] examined that Research-computing access also varies substantially by institution



Computational capacity $\neq$ hardware alone

Can The Challenge Be An Ecosystem Problem?



➤ **Johnston et al., 2024 (HPC Ecosystems Project)**

- ✓ 35 HPC systems across 11 countries, more than 30 formal workshops, over 700 participants

➤ **Galiwango et al., 2025 (Ten Simple Rules for Sustainable HPC)**

- ✓ Framework assessing sustainable HPC in resource-limited environments as an institutional problem

Uneven pathways, access, workforce development, and sustainability

A Pathway Into Computational Research

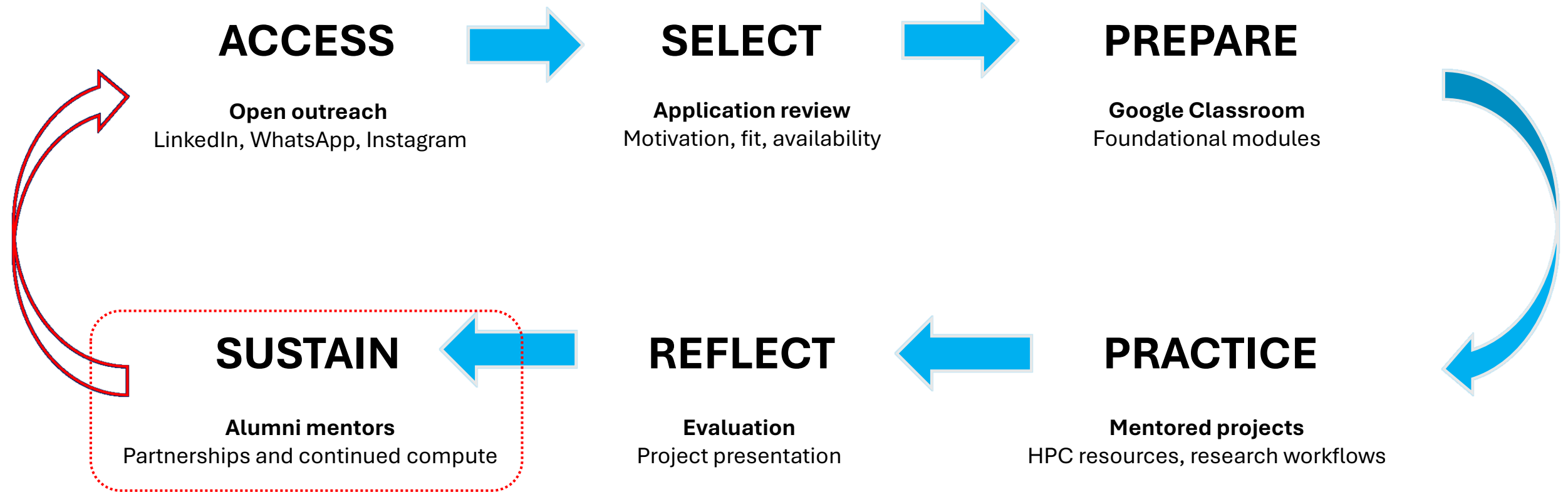
Q1: Who do we reach?

Q2: What barriers do they have?

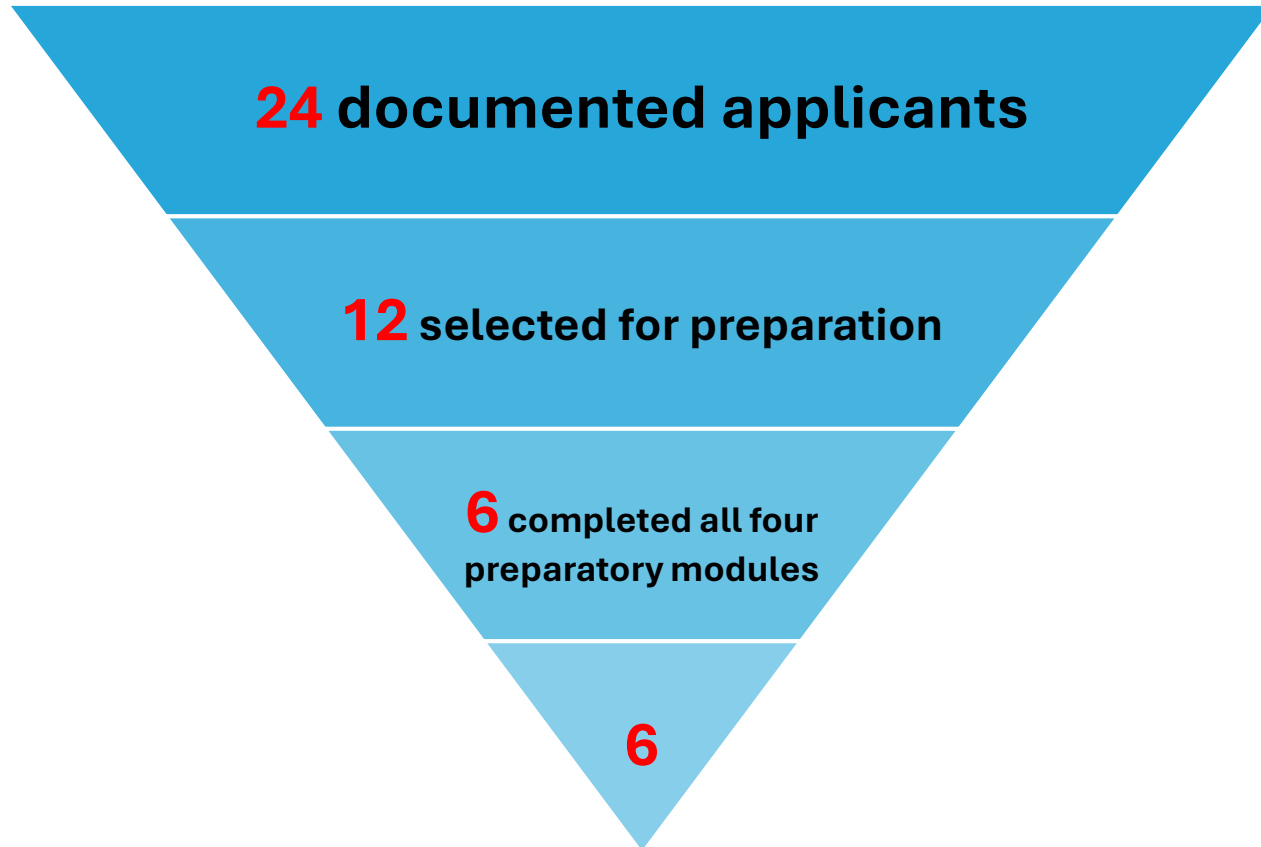
Q3: Will they see value in the proposed pipeline?



The Training Pipeline



Interest Was Much Larger Than The Final Cohort



25% of applicants reached the project phase

What we don't know yet: why selected applicants did not complete preparation.

Time burden?
Connectivity?
Difficulty?
Competing obligations?

What will scaling up look like?



Complimentary Resources And Seminars

- Research **seminars from experts**
- Office hours & **24/7 support** from Boise State University HPC team
- **Expert connections** for potential opportunities
- Certificates/**Proof of participation**
- Alumni community/network and **mentorship**



Center for Computational Research and Education

Join us for our **HPC Skills Research Symposium!**

Title:

The HPC Ecosystems Project

- **Connect** with computational research experts &
- **Engage** in computational research discussions

 **Saturday, May 30th, 2026**

 **5 - 6 PM GMT**

 **Microsoft Teams**

 @centerforc_r_e



Speaker: **Bryan Johnston**

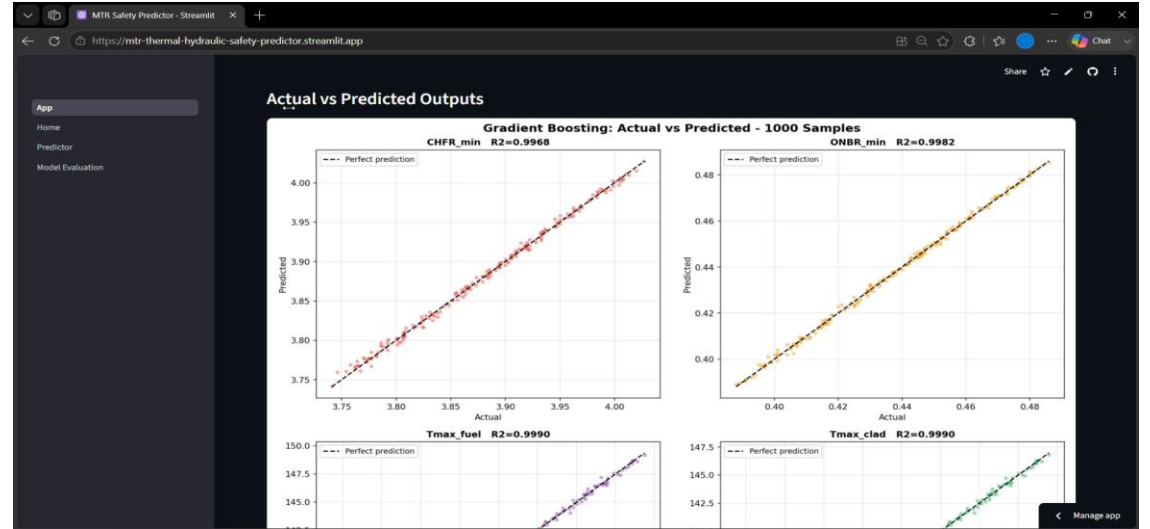


Mentored Group Projects

Reactor Project

Thermal-hydraulic surrogate modeling

- 10 MW Material Testing Reactor
- 1,000 HPC-generated PLTEMP/ANL samples
- Random Forest
- Gradient Boosting
- Feed-forward neural network
- interactive Streamlit deployment

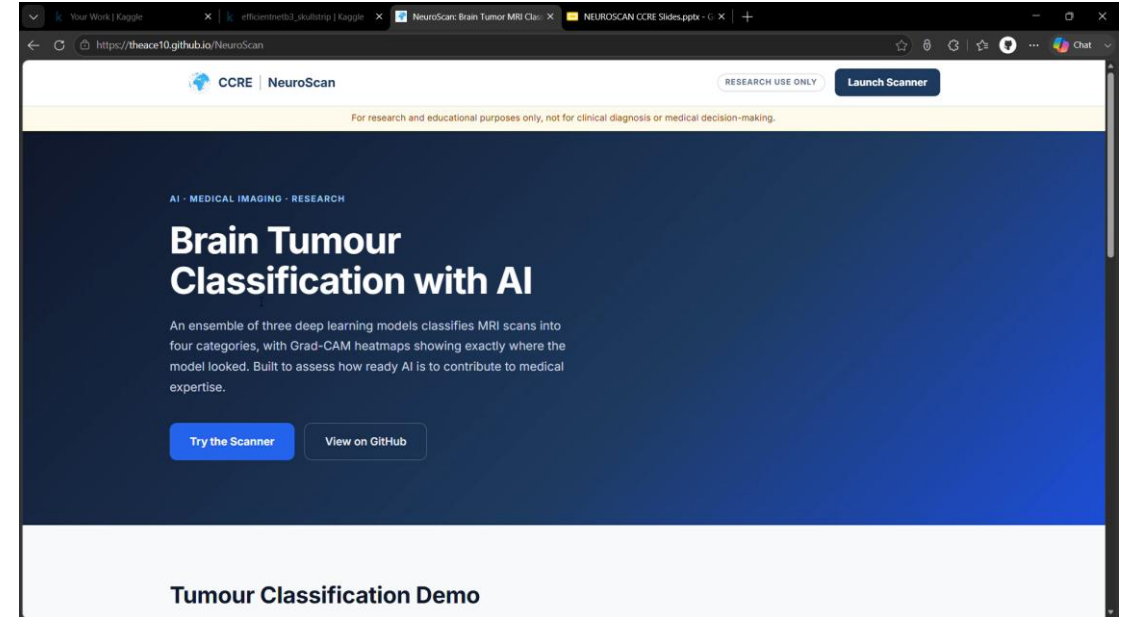


Mentored Group Projects

MRI Project

Brain-tumor MRI Classification

- EfficientNetB3
- VGG16
- DenseNet121
- ensemble classifier
- web application
- Grad-CAM explainability



Most Entered Without Prior HPC Access

5 / 6

No previous HPC access

0 / 6

University-provided HPC access

0 / 6

Completed a full university HPC course

Engineering — 3
Physical sciences — 1
Computational biology/bioinformatics — 1
Other — 1

- ✓ No local HPC mentors: 100%
- ✓ No HPC access: 83.3%
- ✓ Compute cost: 83.3%
- ✓ No structured curriculum: 66.7%
- ✓ No nearby peers: 66.7%
- ✓ Unreliable internet: 16.7%

24 participants

What brought them in?

6 / 6

- Build practical HPC skills
- Join a research-computing community
- Learn collaborative software practices
- Explore computational methods in their domain

Ponce et al. (2019): research-computing training increasingly serves disciplines beyond traditional computing.

Barriers cut across infrastructure, cost, human expertise, and community

What We Know And What Comes Next

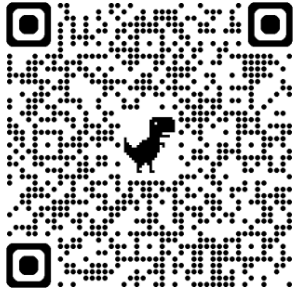
- The staged model was feasible for this pilot
- Participants reported high perceived value
- The cohort entered with substantial access and mentorship barriers
- Projects were executed
- Structural compute/mentor/cost barriers remained

- Skills assessment
- Long-term participant tracking
- University and research group partnerships
- Scaling beyond Ghana and Nigeria

Conclusion and Next Steps

- You have a role to play.
- There is a clear gap we are addressing.
- Communities and institutional partnerships make participation sustainable.

Preprint



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YouTube: <https://www.youtube.com/@CenterforComputationalResearch>

CCRE Pilot Study

Afful et al., 2026

Introducing HPC-Enabled Computational Research Training in Africa: A Pilot Study

Asante Ngiyabonga Enkosi
Daalu Dankie Na gode E se
Shukran Ameseginalehu Mahadsanid
Thank You Xie xie
Arigatou
Gamsahamnida
Dhanyavaad Cảm ơn Terima kasih
Khop khun Nandri Dhanyavadalu
Dhonnobad Mamnoon
Teşekkür ederim
Thanks Thanks mate Ta