The RIPA Model: An Integrated Process Framework for STEM Gender Equity in Africa

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Abstract

Gender equity in Science, Technology, Engineering, and Mathematics (STEM) education remain a persistent structural challenge in Ghana and Sub-Saharan Africa. Despite growing efforts in STEM initiatives, interventions are often fragmented – lacking a coherent framework that connects evidence generation to program delivery, practice, and systemic advocacy. This working paper introduces the RIPA Model,a four-stage integrated process framework developed by Eduvision Foundation that sequences Research, Implementation, Practice, and Advocacy as a continuous, self-reinforcing cycle. The model emerged from two years of field-based work in Tamale, Northern Region of Ghana (June 2023–2025), during which Eduvision Foundation reached over 800 girls, partnered with 16 schools across basic, senior high, and university levels, and established four school-based STEM clubs in basic schools and a dedicated STEM Innovation and Leadership Centre. The study uses a mixed method approach that includes evidence, program participation data, student confidence surveys, school partnership records, and existing literature on STEM gender equity in Africa. This paper presents the theoretical foundations, operational logic, and practical application of the RIPA Model. It argues that for STEM gender equity to be sustainable in Africa, it requires an integrated cycle in which research continuously informs action and advocacy continuously renews research and not fragmented interventions. The paper is relevant for Government agencies and bodies, NGOs, institutions and organisations working on gender issues in STEM and International Bodies. It has implications for education policy in Ghana and across the African continent and establishes a pipeline of empirical research studies that will follow.

Keywords: *STEM gender equity, RIPA Model, process framework, girls in STEM, Northern Ghana, integrated education model, advocacy, implementation science.*

1. Introduction

The underrepresentation of girls and women in STEM fields is a pressing challenge in African education. Globally, and particularly in Ghana, structural barriers, including limited school resources, gender norms, lack of female STEM role models, and insufficient teacher training,

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compound to create an environment in which girls' participation in STEM remains significantly below that of their male peers (UNESCO, 2021; World Bank, 2022).

In response to this challenge, many interventions have tended to be programmatic rather than systemic: mentorship programs that operate in isolation, STEM clubs without research grounding, policy advocacy disconnected from evidence on the ground, or prototypes from robotic competitions that remain on shelves. The missing link is a model that integrates these activities and programs into a coherent, sequenced, and self-reinforcing process.

This paper introduces the RIPA Model, developed by Eduvision Foundation through three years of field-based practice in Tamale, Ghana, as a response to this gap. RIPA stands for Research, Implementation, Practice, and Advocacy. The model argues that for STEM gender interventions to be effective, these four activities should not operate as independent pillars but sequential stages in an integrated process: research must precede and inform implementation; implementation must be tested in authentic practice settings; and the outcomes of practice must drive targeted advocacy, which in turn generates new research questions, closing the cycle.

The contribution of this paper is threefold: first, it introduces and theoretically grounds the RIPA Model; second, it demonstrates its application through Eduvision's work in Northern Ghana; and third, it establishes a foundation for a pipeline of empirical research studies that will provide rigorous evidence for each stage of the model.

2. Background and Problem Statement

2.1 STEM Gender Gaps in Sub-Saharan Africa

Across Sub-Saharan Africa, girls remain significantly underrepresented in STEM education at secondary and tertiary levels. UNESCO (2021) estimates that women constitute less than 30% of STEM workers in the region, a figure that masks even starker disparities in rural areas. In Africa, less than 25% of the youth in pursue STEM fields, with the number being lower among women. Only 30% of STEM students in Africa are women, and merely 13% of African researchers are female (UNESCO, 2021). The lack of adequate resources significantly hinders the progress of STEM education.

In Ghana's Northern Region, one of the country's most educationally underserved areas, STEM participation rates for girls are constrained by a confluence of factors: high rates of early marriage and pregnancy, limited school infrastructure, a scarcity of female STEM teachers as visible role models, and community norms that do not consistently affirm girls' academic ambitions in technical fields (Nkansah,2021; Ofori,2018).

2.2 The Limits of Fragmented Interventions

The development and education sectors have responded to these disparities with a range of interventions. Mentorship programs, STEM competitions, scholarship schemes, and curriculum reforms have all demonstrated localised success. However, the research literature consistently identifies a critical weakness: these interventions are rarely connected to each other, to the evidence base, or to policy systems in a way that allows for cumulative impact (Peppler, 2013; Master et al., 2017).

Without a framework that connects evidence to action and action to systemic change, even well-designed interventions remain time-limited, donor-dependent, and difficult to scale. The RIPA Model was developed precisely to address this integration gap.

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3. The RIPA Model

The RIPA Model is an integrated process framework that organises STEM gender equity work into four sequential, interconnected stages: Research (R), Implementation (I), Practice (P), and Advocacy (A). The model is designed as a cycle: Advocacy feeds back into Research, ensuring that the framework is self-renewing and continuously evidence informed.

MODEL STATEMENT

The RIPA Model positions Research as the foundation of equitable STEM education, sequentially informing Implementation, grounding Practice, and driving Advocacy, which in turn generates new research questions, creating a self-reinforcing cycle of evidence-based change.

3.1 Stage R - Research

The Research stage is the foundational stage of the RIPA Model. Before any program is designed or delivered,Eduvision conducts structured evidence-gathering: reviewing existing literature on STEM gender equity in Africa, analysing policy documents and data from the Ghana Education Service, and conducting field-based surveys and observations in partner schools. The primary output of this stage is the Eduvision Insights series, a research and analysis newsletter that synthesises findings on STEM education in Africa for practitioners and policy audiences.

Research in the RIPA Model is not a one-time activity. It is an ongoing process that feeds continuously into program design and is renewed at the Advocacy stage when outcomes from practice surface new questions. The research stage of the RIPA model is a decisive and critical stage as errors at this stage will translate into wrong Implementation, Practice and Advocacy.

3.2 Stage I- Implementation

The Implementation stage translates research evidence into structured program interventions. Eduvision's implementation activities include girls' STEM mentorship programs, school-based STEM clubs, teacher training and capacity-building initiatives, and school and community partnership programs. Critically, each program is designed with explicit reference to the evidence gathered in the Research stage, therefore ensuring that interventions are contextually grounded, not generically imported.

Since June 2023, Eduvision has implemented programs reaching over 800 girls across 4 basic schools, 10 Senior High Schools, and 2 universities in Ghana. Four STEM clubs are currently active in basic schools, operating year-long embedded programs.

3.3 Stage P - Practice

The Practice stage is where program learning meets authentic, real-world application. The Eduvision STEM Innovation and Leadership Centre in Tamale serves as the primary Practice stage infrastructure. The Centre provides hands-on STEM facilities for schools that lack their own laboratory or technology resources, and serves as a safe, affirming space for girls to explore STEM identity and capability.

The Centre is also a data collection environment: outcomes observed here — student confidence, skills acquisition, teacher behavior change, are systematically recorded and fed back into the Implementation and Research stages, ensuring that the model is grounded in real evidence rather than assumption.

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3.4 Stage A - Advocacy

The Advocacy stage is where evidence from Research, Implementation, and Practice is translated into influence on policy, public discourse, and systems change. Eduvision's advocacy activities include the Eduvision Voices Podcast — a platform that amplifies the voices of educators, researchers, policymakers, and young women in STEM — as well as policy brief publication and stakeholder engagement.

Importantly, the Advocacy stage closes the RIPA cycle: conversations with policymakers, community leaders and practitioners surface new questions and gaps that become the inputs for the next round of Research. This feedback loop is what makes the model dynamic rather than static.

3.5 The RIPA Model at a Glance

Stage	Pillar	Core Activity	Eduvision Expression	Primary Output
R — Research	Insights	Generate evidence on STEM gender gaps, policy landscapes, and intervention effectiveness	Eduvision Insights Newsletter; literature synthesis; field surveys	Research briefs, evidence base
I — Implementation	STEM Programs	Design and deliver evidence-based programs — STEM clubs, mentorship, teacher training	Eduvision STEM Gender Equity Programs; school partnerships; capacity building	Program data, outcome metrics
P — Practice	STEM Centre	Apply learning in authentic settings; test what works with real learners	Eduvision STEM Innovation & Leadership Centre, Tamale; hands-on STEM practice	Outcome evidence, case data
A — Advocacy	Voices Podcast	Translate evidence and outcomes into policy influence and public discourse	Eduvision Voices Podcast; policy briefs; stakeholder engagement	Policy change, new research Qs

Table 1: The RIPA Model — Stages, pillars, activities, expressions, and outputs

4. Theoretical Grounding

The RIPA Model draws on three established bodies of theory in education and development practice.

4.1 Implementation Science

Implementation science — the study of methods that promote the systematic uptake of research findings into practice — provides the foundational logic for the Research-to-Implementation sequence in RIPA (Fixsen et al., 2005). The model's insistence that programs be evidence-grounded before being delivered reflects core principles of implementation fidelity and contextual adaptation.

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4.2 Participatory Action Research

The Practice stage of RIPA reflects traditions of participatory action research (PAR), in which practitioners are simultaneously researchers and actors (Kemmis & McTaggart, 2005). The STEM Centre's role as both a delivery environment and a data collection site embodies this principle — those closest to the problem are actively involved in generating evidence about it.

4.3 Advocacy Coalition Framework

The Advocacy stage draws on Sabatier and Weible's (2007) Advocacy Coalition Framework, which argues that sustained policy change requires coalitions of actors united by shared beliefs and driven by evidence. Eduvision's use of research outputs and practice outcomes as advocacy inputs reflects this approach — making RIPA's advocacy evidence-led rather than values-only.

5. Evidence from Eduvision's Work

The RIPA Model is not only theoretical — it has been operationalised through Eduvision's work since June 2023. The following evidence supports both the feasibility and the early effectiveness of the model.

5.1 Reach and Partnerships

- Over 800 girls reached across all programs since June 2023
- Partnerships with 4 basic schools, 10 Senior High Schools, and 2 universities
- 3 active school-based STEM clubs running as full school-year programs (launched 2025)
- 1 dedicated STEM Innovation and Leadership Centre operational in Tamale
- Teacher training and capacity-building activities delivered across partner schools

5.2 Program Design Evidence

All Eduvision programs are designed with reference to existing literature on effective STEM gender equity interventions in the African context, including evidence on mentorship effectiveness, the role of same-gender role models, and the importance of family and community engagement in sustaining girls' STEM interest.

5.3 Preliminary Outcomes

While rigorous longitudinal outcome data is the subject of forthcoming empirical studies in the RIPA paper pipeline (see Section 7), preliminary observations from program delivery indicate positive shifts in girls' self-reported STEM confidence, increased teacher awareness of gender-responsive STEM pedagogy, and sustained school engagement with the STEM Centre. These observations form the evidential foundation for the anchor paper's empirical claims and will be formally tested in subsequent studies.

6. Policy Implications

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The RIPA Model carries direct implications for education policy at national and regional levels in Ghana and across Sub-Saharan Africa.

6.1 For Ghana Education Service and Ministry of Education

- STEM gender equity interventions should be funded as integrated cycles, not isolated programs — funding models should require applicants to demonstrate how Research, Implementation, Practice, and Advocacy are connected
- The STEM Centre model should be considered as a replicable infrastructure template for underserved districts lacking laboratory and technology facilities
- Teacher training frameworks should be updated to include gender-responsive STEM pedagogy as a core, not elective, competency

6.2 For Regional and Continental Policy Bodies

- African Union education frameworks (including the Continental Education Strategy for Africa 2016–2025 successor) should adopt integrated process models like RIPA as the standard for STEM gender equity programming
- Research investment in STEM gender equity in northern Ghana and comparable sub-regions is critically underfunded relative to the scale of the problem

6.3 For Donor and Development Partners

- Funding should be structured to support all four RIPA stages — not only the visible Implementation and Practice stages — including sustained investment in Research and Advocacy infrastructure
- Multi-year funding models are essential for a process model like RIPA to complete its cycle and generate cumulative evidence

7. The RIPA Research Paper Pipeline

This working paper is the first in a series of publications anchored in the RIPA Model. The following papers are in development and will provide empirical evidence for each stage of the model:

Paper	RIPA Stage	Suggested Journal	Type
The RIPA Model: An Integrated Process Framework for STEM Gender Equity in Sub-Saharan Africa	All four stages	International Journal of STEM Education (Springer)	Conceptual/Theoretical — ANCHOR PAPER
Girls' STEM Mentorship in Northern Ghana: Evidence from the Eduvision RIPA Implementation Stage	Implementation (I)	Gender & Education (Taylor & Francis)	Empirical intervention study
Community STEM Centres as Equity Infrastructure: A Case Study from Tamale, Ghana	Practice (P)	African Journal of Research in MST Education	Case study

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Paper	RIPA Stage	Suggested Journal	Type
Podcast as Advocacy: Using Eduvision Voices to Bridge Research and Policy in African STEM Education	Advocacy (A)	Journal of Science Communication	Mixed methods
Structural Barriers to Girls' STEM Participation in Northern Ghana: A Policy Analysis	Research (R)	Journal of Education Policy	Policy analysis / systematic review

Table 2: Eduvision RIPA Research Paper Pipeline

Each paper in the pipeline will formally cite this working paper as the foundational framework document. The anchor journal paper (Paper 1) will be submitted to the International Journal of STEM Education upon completion of peer review preparation.

8. Conclusion

The RIPA Model represents Eduvision's contribution to the theory and practice of STEM gender equity in Africa. By sequencing Research, Implementation, Practice, and Advocacy as stages in an integrated, self-renewing cycle, the model addresses a persistent weakness in the field: the disconnection between evidence, action, and systemic change.

Two years of field-based work in Tamale, Northern Ghana — reaching over 800 girls, partnering with 16 educational institutions, and establishing a dedicated STEM Centre — has demonstrated that the model is operationally viable and practically grounded. The early evidence is encouraging. The rigorous longitudinal evidence is forthcoming.

This working paper establishes the RIPA Model as an original intellectual contribution of Eduvision Foundation, authored by Dr Vida Awinime Bugri. It is the anchor document for a pipeline of empirical research, policy briefs, and practitioner publications that will follow. Researchers, policymakers, and practitioners are invited to engage with, test, and build upon the model — with appropriate citation and attribution.

HOW TO CITE

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About Eduvision

Eduvision is a STEM education and gender equity organisation based in Tamale, Northern Region of Ghana. Founded in June 2023 by Dr Vida Awinime Bugri, Eduvision operates across four integrated pillars — Research (Eduvision Insights), Implementation (STEM Gender Equity Programs), Practice (STEM Innovation and Leadership Centre), and Advocacy (Eduvision Voices Podcast) — united by the RIPA Process Model. Eduvision's mission is to expand access to quality STEM education and leadership development for young people, particularly girls, in underserved communities across Africa.

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