THE PROJECT KUONGOZA

From Structural Barriers to Scalable Solutions:

An Evidence-Based Analysis of Technology-Enabled Mentorship as a Lever for Closing the Gender Gap in STEM

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A policy analysis of structural constraints facing girls and young women in science, technology, engineering and mathematics (STEM) initiatives across sub-Saharan Africa, and the Middle East and North Africa (MENA), and the emerging role of digitally supported mentorship as a scalable response.

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Executive Summary

Girls and Women remain significantly underrepresented in Science, Technology, Engineering, and Mathematics (STEM) fields across sub-Saharan Africa and the MENA nations. Despite comprising roughly half of the population, they account for a disproportionately small share of STEM students, researchers, and professionals.

Structural barriers including limited access to quality STEM education, shortage of visible female role models, restrictive social norms, inadequate career guidance, and unequal digital access continue to constrain participation. These gaps limit individual opportunity and reduce the region's capacity for innovation, economic diversification, and inclusive development.

Traditional in-person mentorship has long been recognized as a powerful countermeasure, yet its reach remains constrained by geography, cost, and the scarcity of available mentors. Technology-enabled mentorship—delivered through structured online platforms, hybrid one-on-one and group formats, and increasingly AI-supported matching—offers a fundamentally more scalable alternative.

Technology-enabled mentorship has emerged as a promising approach to address these challenges at scale. When deliberately designed, digital and hybrid mentorship models can expand access to role models, provide continuous guidance, build practical skills, and connect young women to academic and career pathways that would otherwise remain out of reach.

This paper examines the nature of the gender gap, the interlocking barriers that sustain it, and the distinctive advantages of technology-supported mentorship relative to traditional models. It argues that closing the gap requires treating technology-focused mentorship as essential infrastructure for human capital development rather than as an isolated intervention.

The persistent gender gap in STEM

Despite notable progress in expanding access to education across sub-Saharan Africa and the Middle East and North Africa (MENA), a significant gender gap in STEM persists. Girls and young women remain underrepresented in STEM subjects at secondary and tertiary education levels and are even less visible in STEM-related careers and leadership positions.

In many countries across these regions, female enrolment in STEM fields declines sharply as students progress from lower secondary to upper secondary and tertiary education. Even where girls perform well in mathematics and science at earlier stages, fewer transition into advanced STEM tracks or technical and vocational pathways.

01 Structural barriers matrix

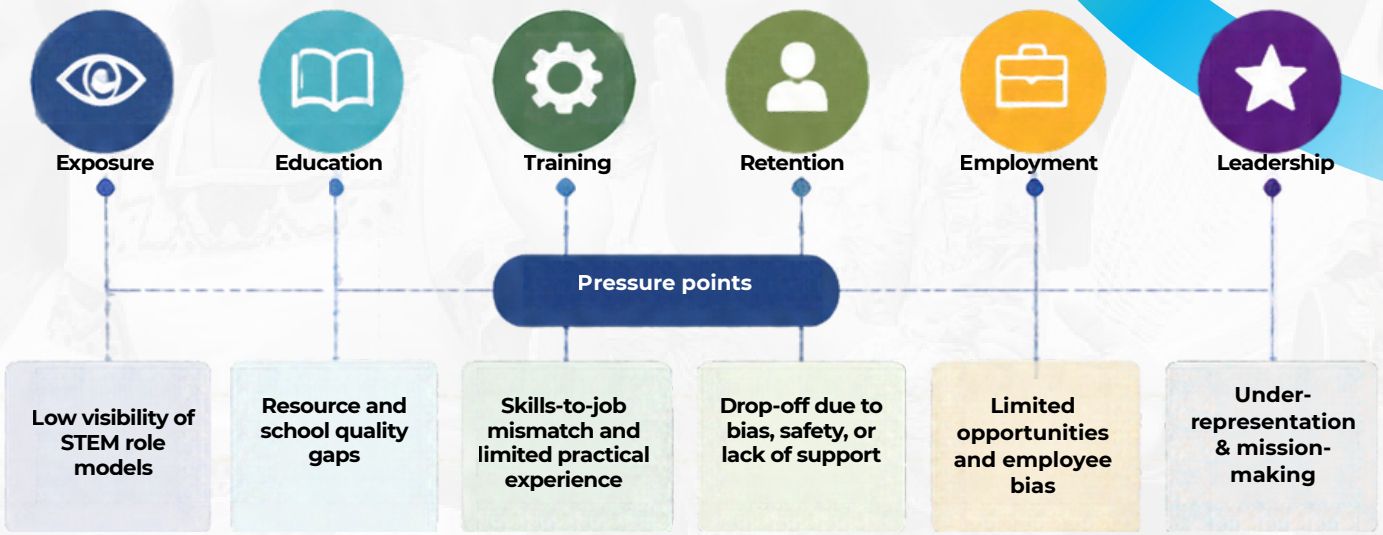
Shared constraints across sub-Saharan Africa and MENA

Barrier	Sub-Saharan Africa	MENA
Access	Limited facilities, equipment, and role models	Geographic and socioeconomic access gaps
Norms	Gender stereotypes and low STEM aspirations	Cultural norms, limit women's STEM participation
Cost	Direct and indirect education and training costs	Affordable and educational and digital tools
Safety	Safety concerns restrict education and participation	Harassment and safety concerns persist
Connectivity	Unreliable internet and electricity	Digital divide in rural and low-income areas
Institutional support	Weak policies and insufficient support systems	Limited enforcement and resource allocation

At the university level, women remain concentrated in life sciences and health-related fields, while remaining significantly underrepresented in engineering, computer science, physics, and other technology-intensive disciplines.



02 **STEM participation pipeline**



This educational disparity translates directly into the labour market. Women constitute a minority of the STEM workforce in most sub-Saharan African and MENA countries, and they are particularly scarce in high-growth digital, engineering, and innovation-driven sectors.

The result is a dual loss where young women are denied access to some of the most secure, well-paid, and future-oriented career opportunities, while economies forgo a substantial portion of their available talent at a time when digital transformation and technological capability are central to competitiveness and development.

Closing the gender gap in STEM is therefore not only a matter of equity; it is a strategic development challenge.



Barriers facing girls and young women in STEM endeavours

Multiple, interrelated barriers constrain the participation and progression of girls and young women in STEM. These barriers operate at individual, institutional, community, and systemic levels. Some of these barriers and limitations include:

Limited role models:

Many girls grow up with little or no exposure to women who work in STEM fields. The absence of visible female scientists, engineers, technologists, and innovators reinforces the perception that these careers are not intended for them. Without relatable role models, girls are less likely to imagine themselves in STEM pathways or to persist when they encounter difficulty.

Weak career guidance:

Career counselling systems in many schools remain underdeveloped or outdated. Students, particularly those in under-resourced schools, often receive limited information about STEM career options, required competencies, or emerging opportunities in the digital economy. Guidance, when available, frequently reflects traditional gender norms rather than current labour-market realities.

03 Mentorship intervention flow





Digital access gaps:

Unequal access to devices, reliable internet, electricity, and digital skills creates a significant barrier. Girls in low-income, rural, and peri-urban communities are disproportionately affected. Even when digital tools are available, they are not always integrated into learning in ways that build confidence and competence. The growing importance of digital literacy and artificial intelligence (AI)-related skills further widens the gap for those who lack early and meaningful exposure.

Social and cultural norms:

Prevailing social expectations about gender roles continue to shape subject choice, parental investment, and students' self-perception. In some contexts, STEM fields are still viewed as masculine domains, while girls are steered toward caregiving or less technical disciplines. Concerns about safety, mobility, and balancing future family responsibilities can also influence decisions against pursuing demanding STEM pathways.

Inadequate school-to-work pathways:

Even when girls succeed in STEM education, the transition into employment or entrepreneurship is often weakly supported. Limited industry linkages, few structured internship opportunities, insufficient mentorship during the transition period, and gender biases in recruitment processes reduce the conversion of educational attainment into career participation. Without deliberate bridging mechanisms, educational gains do not automatically translate into labour-market outcomes.

These barriers do not operate in isolation. They interact and reinforce one another, creating cumulative disadvantages that become more difficult to reverse at later stages of education and career development.



4 Digital mentorship scalability

Peer Communities

Support from Local Mentors and peers in Communities

Scalable ecosystem

Continuous learning and courage to take on capstone projects

Simulations

Reusable resources, toolkits and assessments

Digital Infrastructure

Mobile access (anytime, anywhere) for virtual mentorship session

Why traditional mentorship alone is insufficient at scale

Mentorship has long been recognised as a powerful mechanism for supporting girls and young women in STEM. Face-to-face mentorship offers relational depth, trust-building, and contextual understanding. However, traditional, purely in-person models face structural limitations when the goal is population-level change across sub-Saharan Africa and the MENA region.



A qualitative comparison of reach, continuity and equity

TRADITIONAL 1:1 MENTORSHIP

Valuable relationship — limited coverage

- **Limited mentor availability**
  Few mentors must carry high demand
- **Geographic reach**
  In-person access favors connected locations
- **Scheduling friction**
  Shared time windows are hard to sustain
- **Inconsistent access**
  Continuity varies across participants
- **High coordination load**
  Matching and follow-up stay manual

SCALE LIMIT

DIGITALLY SUPPORTED MENTORSHIP

Amplifies mentors — broadens the support layer

- **Virtual access**
  Connect beyond a single place
- **Peer communities**
  Extend support through shared learning
- **Reusable resources**
  Make guidance available on demand
- **Flexible touchpoints**
  Fit different schedules and contexts
- **Local mentor amplification**
  Keep relationships human while increasing reach

POLICY IMPLICATION **Traditional mentorship remains essential, but digital layers are needed for broad, continuous, and equitable coverage.**

- The supply of suitable mentors is constrained; women already working in STEM remain a minority in most countries.
- Geographic concentration of mentors in urban centres and elite institutions leaves girls in peri-urban, rural, and underserved communities with little or no access.
- Traditional mentorship is often episodic — dependent on physical meetings or short-term programmes — making sustained engagement over multi-year journeys difficult.
- The cost and logistical complexity of organising high-quality, in-person mentoring at national or regional scale are high, limiting both reach and sustainability.
- As a result, while traditional mentorship produces meaningful results for those who access it, it has proven difficult to expand equitably or rapidly enough to close systemic gender gaps. Relying on it alone risks reinforcing existing inequalities.



Unique advantages of digital and hybrid mentorship models

Technology-supported mentorship, particularly hybrid models that combine digital platforms with periodic in-person or live interaction, addresses many of the scalability constraints of traditional approaches while preserving the human core of mentoring relationships. This can be achieved through:

Reach.
Digital tools allow mentorship to transcend geographic boundaries. A mentor based in a capital city or another country can support mentees across multiple regions, dramatically expanding the effective mentor pool.

Continuity.
Digital platforms support ongoing communication through messaging, scheduled virtual meetings, shared learning resources, and progress tracking — especially valuable during critical transition points such as subject selection, examinations, university applications, and early career decisions.

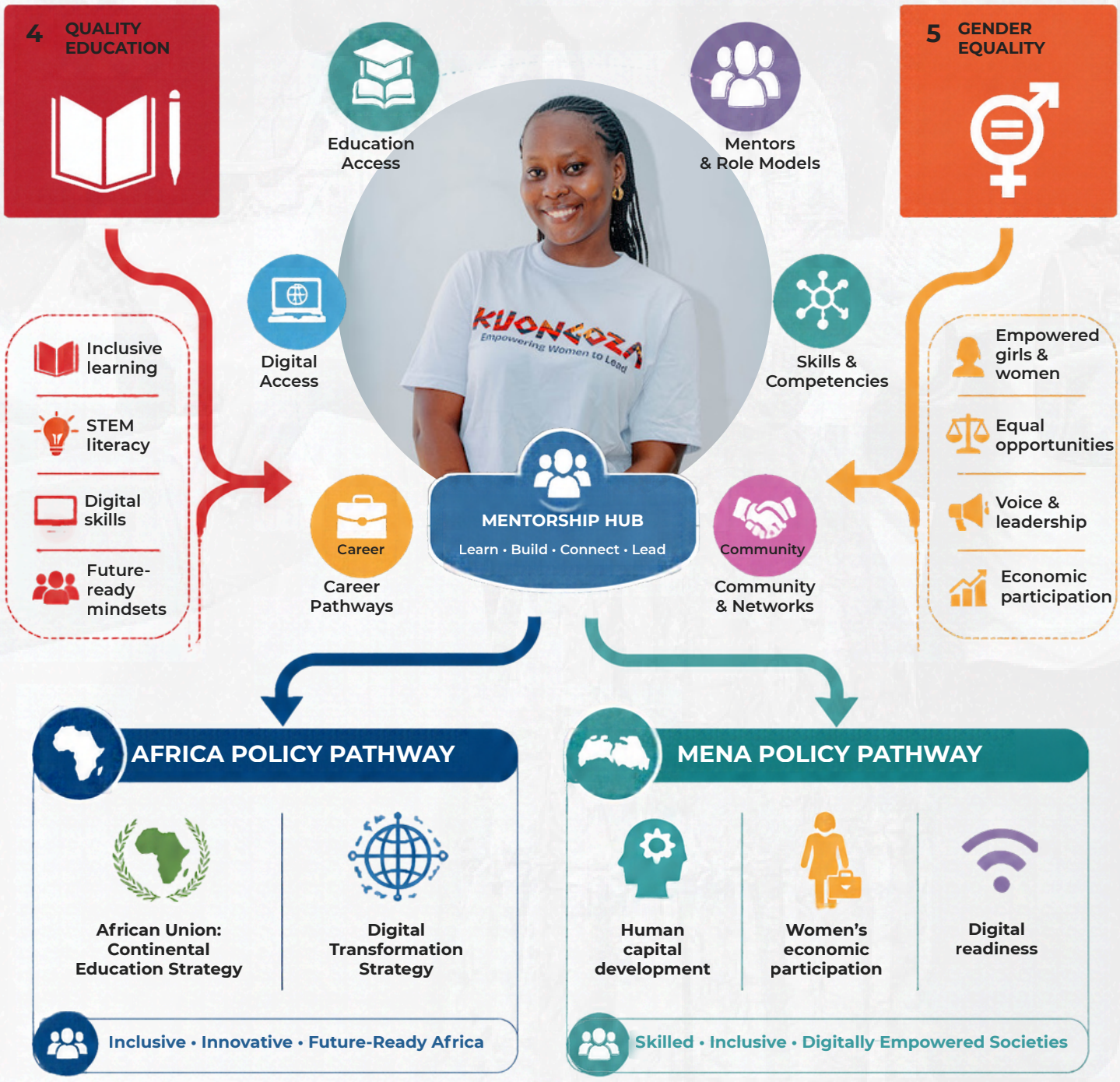
Cost-effectiveness.
Once core digital infrastructure and content are developed, the marginal cost of adding additional mentees is relatively low compared with purely in-person models that require repeated travel and intensive local coordination.

Data-driven matching and improvement.
Digital platforms enable more systematic matching of mentors and mentees and generate data on engagement patterns, common challenges, and outcomes that can be used to refine programme design.



Alignment with regional and global priorities

Technology-enabled mentorship offers a practical mechanism for operationalising these commitments at the level of individual learners. Below is a connected policy ecosystem for girls and young women in STEM



The expansion of technology-focused mentorship for girls and young women in STEM is strongly aligned with Sustainable Development Goal (SDG) 4 (Quality Education) and Goal 5 (Gender Equality).

Within Africa, it resonates with the African Union's Continental Education Strategy and Digital Transformation Strategy. In the MENA region, national visions increasingly prioritise human capital development, women's economic participation, and digital readiness.











Based on the analysis of barriers and the comparative advantages of technology-supported approaches, the following priority actions are recommended for policymakers and education stakeholders:

Recommendations

01

Explicitly recognize the structural nature of the gender gap in STEM initiatives within national education and gender strategies, moving beyond awareness-raising towards concrete targets for participation and progression.

02

Position technology-enabled and hybrid mentorship as a core complementary strategy within STEM education and school-to-work transition frameworks, rather than as an optional or donor-driven activity.

03

Prioritize investment in low-bandwidth and offline-friendly digital solutions so that girls in rural, peri-urban, and low-income settings are not excluded from mentorship opportunities.

04

Strengthen career guidance systems in secondary schools by integrating exposure to STEM role models and labour-market information that challenges traditional gender stereotypes.

05

Establish baseline data systems that track gender-disaggregated STEM enrolment, subject choice, and early career transitions to inform policy and measure progress.

Conclusion



The gender gap in STEM across sub-Saharan Africa and the MENA region is persistent, multi-layered, and costly — both for the young women denied opportunity and for the economies that forgo their talent.

Traditional mentorship, while valuable, cannot alone deliver the scale and equity required. Technology-focused and hybrid models offer distinctive advantages of reach, continuity, cost-effectiveness, and data-driven improvement.

Realizing this potential, however, depends on deliberate policy recognition that such mentorship is an essential infrastructure for inclusive human capital development.

The following papers in this series examine implementation evidence, effective design principles, the policy strategies needed for scale, and a roadmap for institutionalization.

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