

Empowering Girls to Pursue STEM in Africa: An Interdisciplinary OER Program, Co-Branded with UNESCO under a new Pilot Program, Is Inspiring Students, Engaging Teachers, and Garnering Significant Stakeholder Interest

One of the 21st century skills students need to be responsible citizens is technological literacy. Every aspect of the world we live in today is impacted by technology. “In order to be a technologically literate citizen, a person should understand what technology is, how it works, how it shapes society and in turn how society shapes it.” (ITEEA, 2000/2002) Yet many students fall below technological literacy proficiency levels.

While there are numerous STEM resource programs available that focus on what technology is and how it works, there are few that focus on the social and humanistic context of technology. One of the best ways to teach these technological literacy skills is through the lens of history! History provides an opportunity to increase cultural awareness and deepens an understanding of the world in which we live. History also provides a sense of identity. IEEE REACH (reach.ieee.org), a pre-university, open education teacher resource program, is leading the way in this effort. It bridges the gap between Humanities and STEM by exploring the history of technology, its impact on society, and how society has influenced the evolution of technology. The goal of the REACH program is to improve *all* students’ technological literacy skills as necessary for college, career, and civics – and to be responsible and informed citizens in today’s tech world. The resources also provide a new STEM education pathway, by engaging students through historical narratives.

IEEE, a U.S. 501(c)3 organization, is the world’s largest technical professional organization dedicated to advancing technology for the benefit of humanity. Its History Center is dedicated to promoting awareness and appreciation of engineering and its social impact through exploring and making known its history; REACH is its pre-university program. REACH lesson plans are researched and vetted by PhD. Historians. The plans include formative and summative performance tasks, excerpted documents, and civic actions, which make the material relevant to students’ lives today. They are designed in an inquiry format which encompasses engaging students through compelling questions and inquiry, using and evaluating evidence to answer questions and communicate answers, and participating in civic actions. Inquiries are supported by primary sources, short engaging student videos and hands-on activities.

The resources are available via the REACH website and meet both US and International education standards. They may be used in either a formal or informal environment and are available offline as all content is downloadable.

As part of an IEEE Memorandum of Understanding with UNESCO, the REACH program partnered with UNESCO on a co-branded pilot program that delivered the REACH resources to students (predominantly girls) in Uganda, Africa. Silver Bolt, a Uganda non-profit education organization, adapted the resources to meet Uganda’s National Curriculum Development Centre’s (NCDC) standards based on a new curriculum modeled around 21st Century skills. The

pilot was carried out at Smart Girls Foundation, a non-profit, girl-centered development organization; and throughout under-served communities surrounding it, for learners and teachers. Stereotypically, in STEM, roles and abilities are often referred to as more “suitable” for males than females. A deliberate effort was made to deliver the REACH resources to the girl child in the Wakiso district, who has either not received or has attained lower levels of formal education.

As recommended by Uganda’s NCDC, all pedagogy was aimed at using the history of science, engineering and innovation to spark creativity, boost critical thinking, collaboration, teamwork and communication. To meet the learners needs, the team contextualized and delivered the REACH resources based on the learners’ language, education levels and the communities they lived and studied in.

The nature of the REACH resources allowed for high levels of contextualization and relevance through the use of the performance tasks or assessments and inquiry formats while maintaining the historical facts. A “training of trainers” also took place, comprised of pre-service and in-service instructors, teachers and parents, and emphasized points of interest and application along both formal and informal curricula.

The diverse application of REACH enabled delivery of the resources, leading durations of 4 weeks, 4 days and 2 hours in the communities with a reach of close to 1000. With the learning engagements optional, there was a sustained attendance of 76% with the highest attendance for the formative assessments. 52% of the learners were above 18 years of age and 48% were aged 12 - 18, with over 75% being female learners. The implementation of the program achieved an average 16.2-point change in knowledge with over 72% finding the REACH topics relevant, and 76% aware of the next steps they would take following the outreach.

Following the success of the REACH/UNESCO pilot, IEEE and Silver Bolt were invited to present at a UNESCO STEM mentorship workshop, supported by the Uganda National Commission for UNESCO and IEEE, and attended by educators and key stakeholders from both UNESCO and the Uganda Ministry of Education. The goal was to equip Science teachers in the region with tools to realize improvements in participation by women and girls in STEM education. Teachers participated in IEEE REACH activities just as a student would! They walked away inspired and with a new toolkit and STEM pathway for girls. As a result, the Uganda Ministry of Education is considering a curricular expansion of the program in the country and UNESCO is exploring exporting it elsewhere.

The presentation will share the IEEE REACH resources that cross-cut UNESCO’s sectors of education, science, and culture, offering broad global applications and effective learning outcomes. It will highlight best practices learned from the pilot program including, use and adaptation in formal and in-formal education environments, address how the implementation in the classroom and in in-service workshops garnered key stakeholder interest for OER inclusion as an integral part of future training programs and curricular reformation, and encourage inclusivity and gender equality. Methodology for integration and the international

collaboration will also be accentuated as such has led to greater capacity building, peer networking and an opportunity to potentially transform education, specifically as it relates to both gender inclusion and equity and technological literacy for all students.