Technological innovations for advancing quality education, gender equality and climate action Jaı

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ue to the COVID-19 pandemic, wars and conflicts happening in many parts of the world – to say nothing of the climate crisis – there has been a dramatic increase in poverty, unemployment and number of displaced persons globally, resulting in an educational crisis. The United Nations Global Fund for Education in Emergencies "Education Cannot Wait" estimates that there are 222 million crisis-affected children and adolescents.¹

To help relieve this situation, a number of non-profit and non-governmental institutions have implemented initiatives with the use of technologies (such as mobile phones, smartphones and similar devices) to enable access of quality education (especially climate change education) to children and youth who otherwise would not have such access. Such foundations include 60 Million Girls, Education Above All, Boa Daakye, Gates, Lego, and many others.

I myself joined the 60 Million Girls Foundation as a volunteer researcher in 2017, when I discovered that mobile technologies could bring significant positive impact on girls' education and well-being. This organisation raises funds each year to cover the costs of constructing two schools in the most impoverished places to provide marginalised girls with access to education, via a Mobile Learning Lab. These labs consist of a server, tablets with WIFI, 1TB of learning content (e.g., from Khan Academy) and a solar panel for charging the devices.

In 2019-2020 alone, the 60 million Girls foundation upgraded the external infrastructure of 10 schools in indigenous communities in Guatemala for one school year, and improved, for example, curriculums that did not promote girls' rights and gender equality. The study by Wiebe et al. (2022) showed that there are several comparative advantages of using offline digital technologies for children globally, especially in remote and marginal communities, which can offer up-to-date curriculums promoting gender rights and equality in STEM and other subjects and careers.²

Such technological innovations have enormous potential for closing the existing global education gap for a few reasons: 1) they offer high-quality educational digital resources, thereby replacing the need for print documents; 2) they enable teacher-capacity building and networking; 3) they enhance students' digital literacy; and 4) they aid in the sharing of cultural knowledge.²

Education paves the road to the reduction of poverty,



enhanced economic growth, increased world peace and improved climate protection. Girls are particularly at risk of being left behind and unable to obtain a quality education. The aforementioned approaches are relatively low-cost but can have huge educational impact, and thus have tremendous potential in advancing the United Nations Sustainable Development Goal 4, Quality Education.³

Education can lift families out of poverty and hunger and help secure jobs, and thus advance SDG 1 (No poverty), SDG 2 (Zero Hunger), and SDG 8 (Decent Work and Economic Growth).⁴ As the co-lead of the GYA's Science Education for Youth working group, I am co-organising a Science Education for Youth workshop at the GYA Annual General Meeting and International Conference of Young Scientist 2023, which will cover these topics. The aim is to build both capacity and a supportive network to accelerate joint collaborative efforts.

Technological change can empower both citizens and scientists

Innovations and technological change have the ability to empower both citizens and scientists - particularly women scientists and citizens in underrepresented groups - to help contribute to global advancement and well-being. This can be done in a number of ways: 1) Open Science methods and data sharing beyond borders allow higher-quality data and analytical tools to be utilised; 2) interdisciplinary groups of scientists can work and network effectively to solve global pressing issues and allow many wider dissemination activities across continents; 3) more efficient and effective science communication can take place using sophisticated and professional social media channels; 4) the next generation of science leaders can be mentored remotely, and 5) addressing gender and other inequalities within science

subjects and careers. Thus, technological innovations have tremendous potential in advancing SDG 5 (Gender Equality) and SDG 10 (Reduced Inequalities).⁵

Technological innovations can empower citizens of different ethnicity, age, gender, disability and sexuality as they are invited into the co-design research processes together with scientists, and can thereby improve and increase global well-being as citizens become active stakeholders in their livelihoods and surroundings.

Using modern citizen science methods, it is possible to reach and engage underrepresented groups, not only allowing their voices to be heard, but changing who can be an active part of the change-making process. Specifically, the innovation of mobile games (which have the potential to reach millions of citizens globally) and whether these can be used to facilitate an effective communication channel between citizens and policy-makers in the context of climate emergency, is currently under investigation in a European and UKRI-funded project named Games Realizing Effective and Affective Transformation.⁶

The advancement of such mobile games with state-ofthe-art data analytics allows citizens' opinions, attitudes and preferences to be captured and transferred to relevant policy-makers, with the intention of influencing them to make climate policies that are even more closely matched to citizens' needs. This has the potential to advance SDG 13 (Climate Action). As the appointed program manager for this recently-started project, I am excited to contribute both personal and professional aspirations and skills to help decrease the impacts of the climate emergency for global well-being.

I'd like to finish the article with one of my favorite quotes by Nelson Mandela: "It always seems impossible until it's done."

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