Using STEM research to inform international education policy and practice

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Agenda

- Communicating research to influence programme design, international frameworks on education, and policies.
- Example 1: Culturally relevant science education
- Example 2: STEM & Gender Equality
- Example 3: Climate & Education
- Q & A
- Closing

How do we close the gap between science education research and real-world impact?

- Community-engaged research!

- Strategies that promote uptake of research into the real world
  - Lose the jargon – communicate complexity in easily digestible but compelling manners (use models and diagrams)

  - Active and ongoing partnership with communities affected/benefitting by the studied issues, and with decision makers in government.

  - Show a clear path so that research results can be applied meaningfully to broader populations

Example 1: Contextualization of Science Education Curricula using a culturally relevant approach

- RQ: "What does it mean to contextualize science curricula in a culturally relevant manner for Indigenous middle school students so that learning of challenging science ideas is facilitated?"

- Methods of this study:
  - Ethnographic observations of classrooms and community
  - Cognitive interview to explore teleological bias
  - Semi-structured interviews with students, teachers, elders
  - Analysis of student's artifacts
  - Quantitative analysis of learning gains

Contextualization Principles for Biology Curricula

Using students' culturally-based preference for applying non-teleological reasoning in the plant domain as leverage to support them in developing understanding of complex concepts such as natural selection
Reflecting on teleological types of reasoning when applied to animals through the evaluation of inaccurate evidence-based explanations
Using traditional knowledge as a context to explore Western science concepts and to engage adult members of the community in the classroom
Contrasting TIK and WSK to debunk the idea that students' TIK is inferior to WSK, thus facilitating border crossing while learning science
Foregrounding TIK as a legitimate source of knowledge that can enrich WSK
Challenging the Status Quo and Developing Critical Consciousness
Using technology to incorporate into the unit ways of learning privileged in students' communities

Real world impact

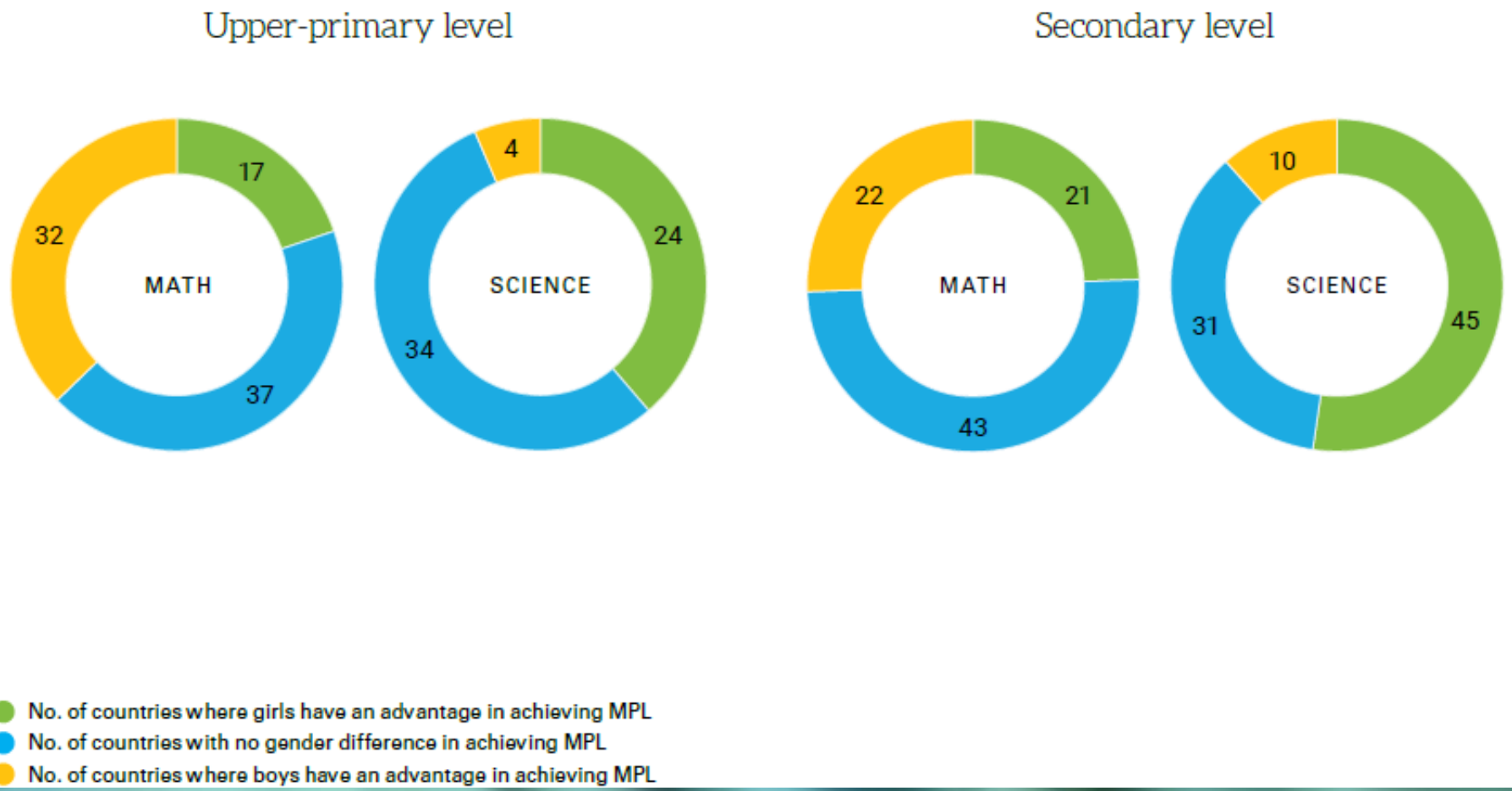
- **Key Findings in a nutshell:**
  - Including culturally relevant information in the natural selection 7th grade unit did not negatively affect students' learning outcomes.
  - Difference between pre and post-test scores was significant, effect size of 0.42 SD. 8 week-unit.
  - Empirically Derived Contextualization Principles were developed that can be applied across contexts.

- **Using the findings and evidence to strengthen Intercultural Bilingual Education in Peru**

  - $25 Mil mobilized from International Cooperation and private sector
  - 9,000 teachers received in-classroom support and materials for implementation
  - 1,790 teachers pursued IBE postgraduate certification
  - Policy: MOE started testing language skills in students mother tongue for Elementary Education

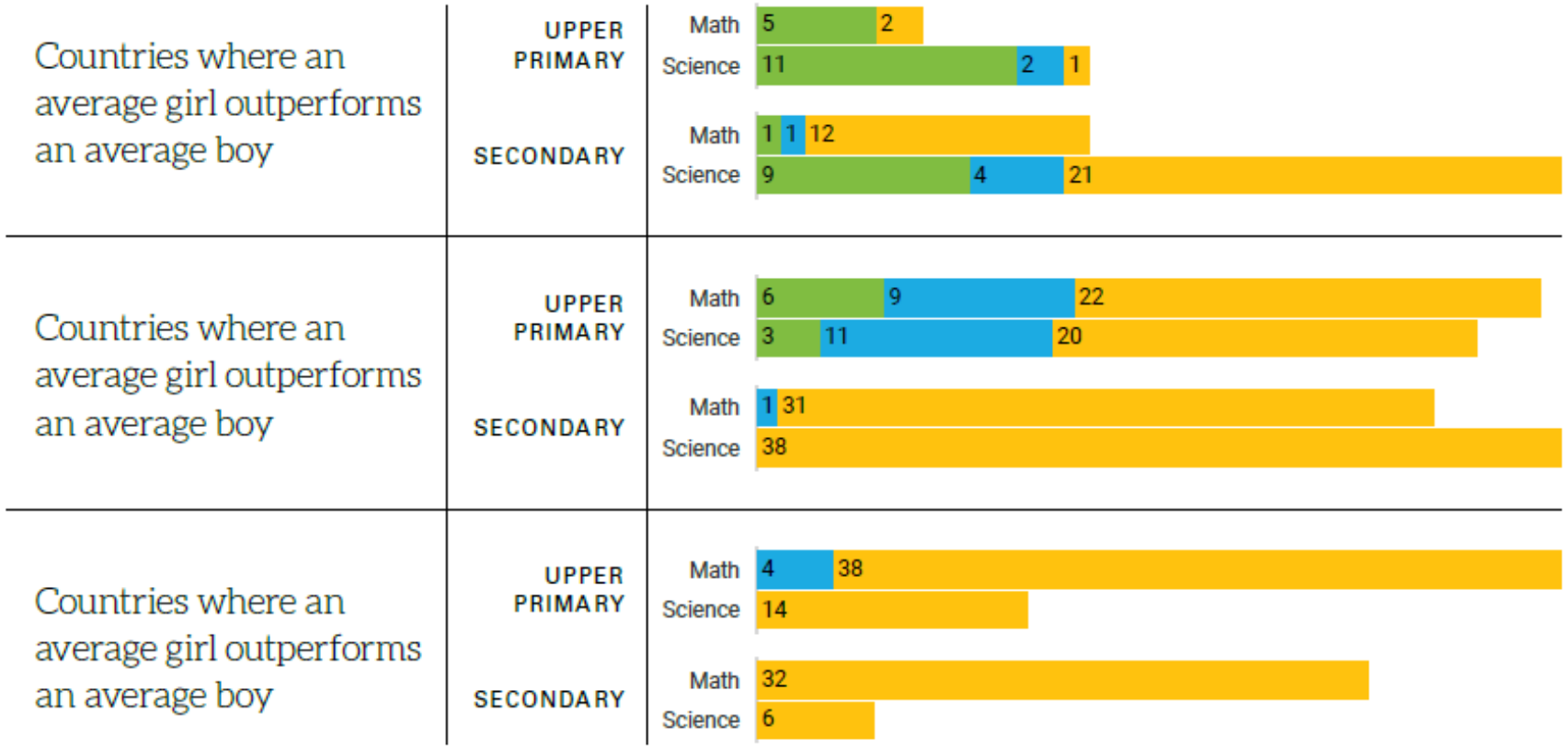
Example 2: UNICEF approach to STEM education a gender-responsive approach

Girls in school are equally or more likely than boys to achieve minimum proficiency levels in math and science[3]



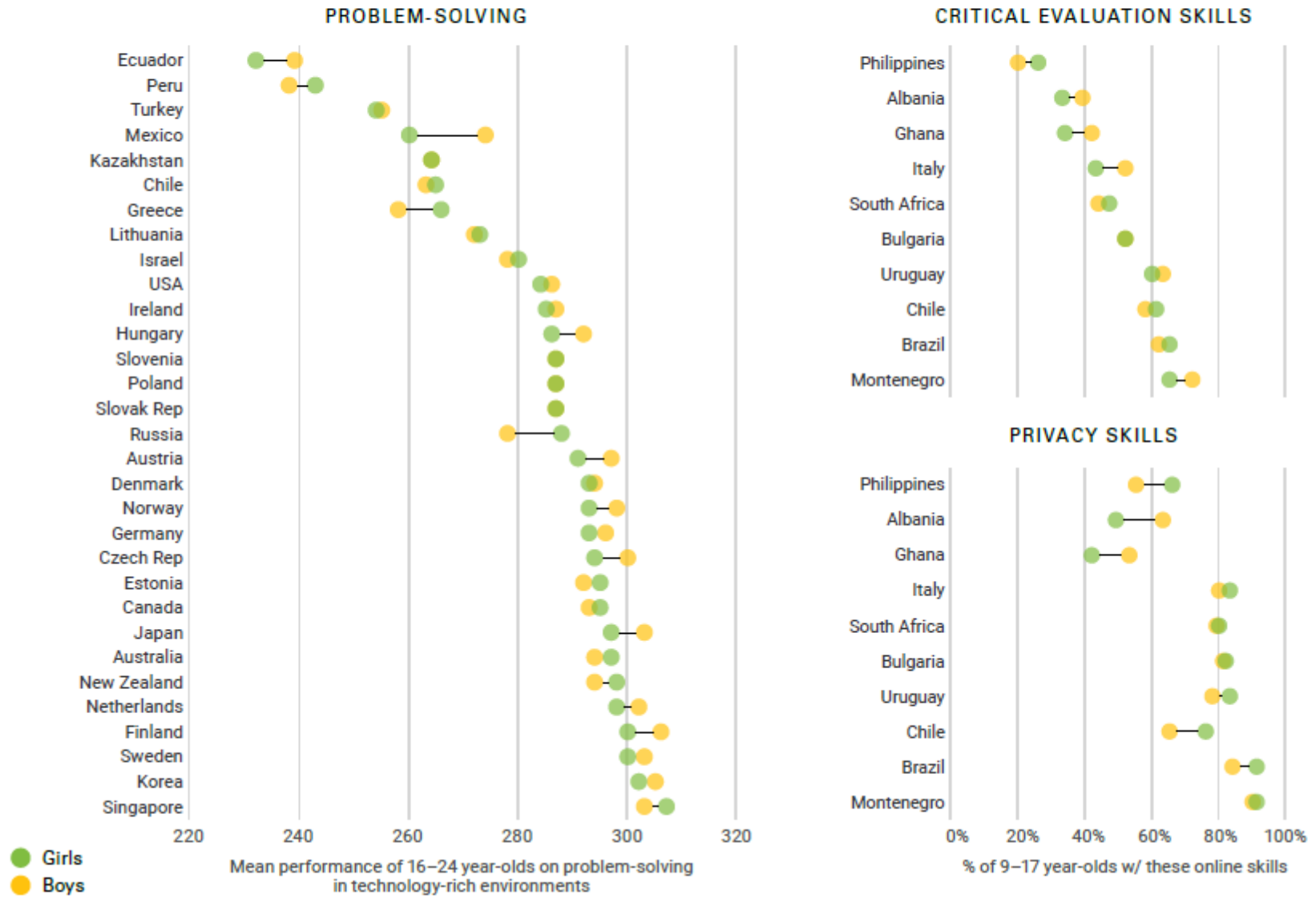
However, this global snapshot masks differences based on students' socio-economic status within countries[6]

Girls are less likely than boys to achieve high proficiency levels in STEM[7]

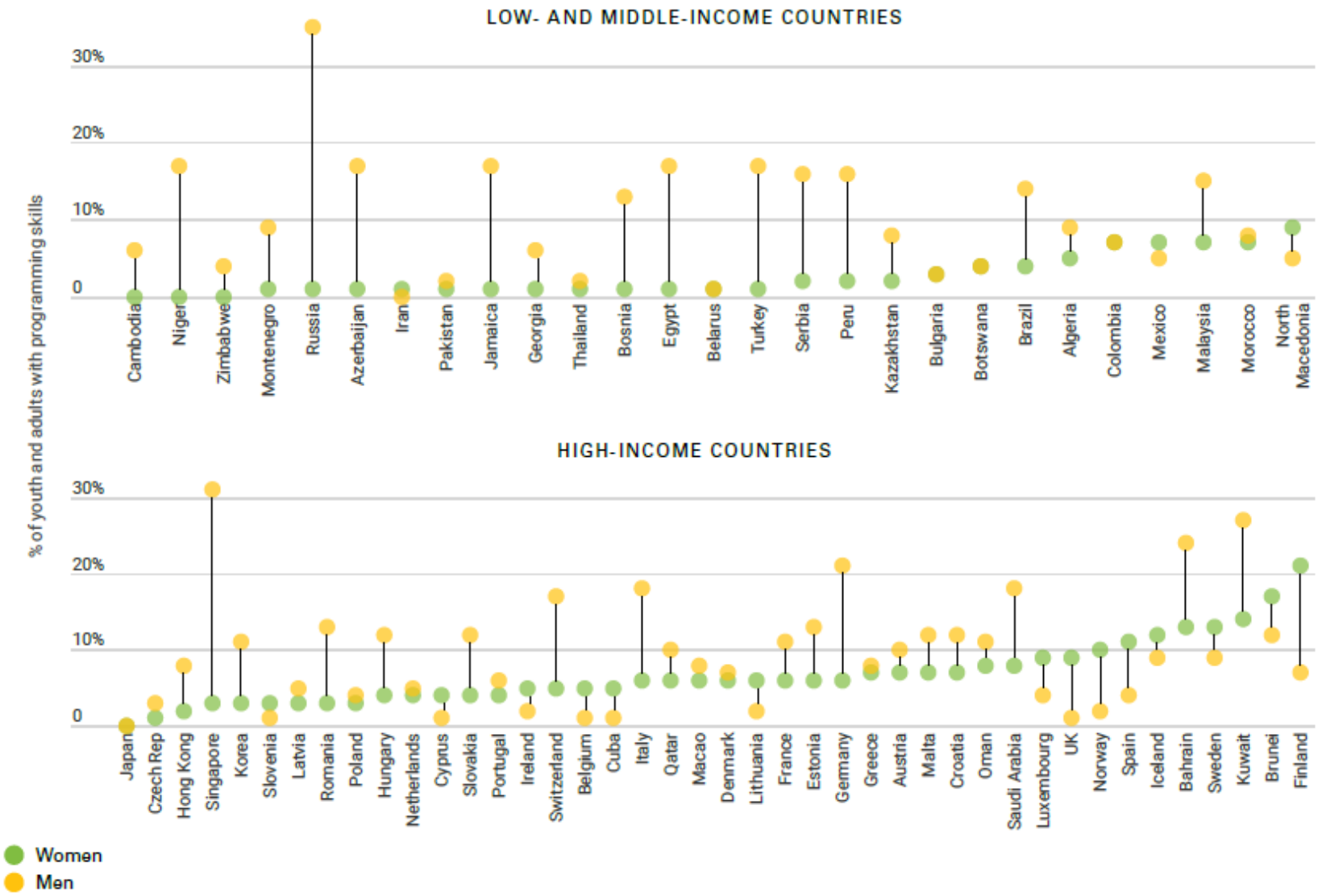


- No. of countries where girls have an advantage in achieving high proficiency levels
- No. of countries with no gender difference in achieving high proficiency levels
- No. of countries where boys have an advantage in achieving high proficiency levels

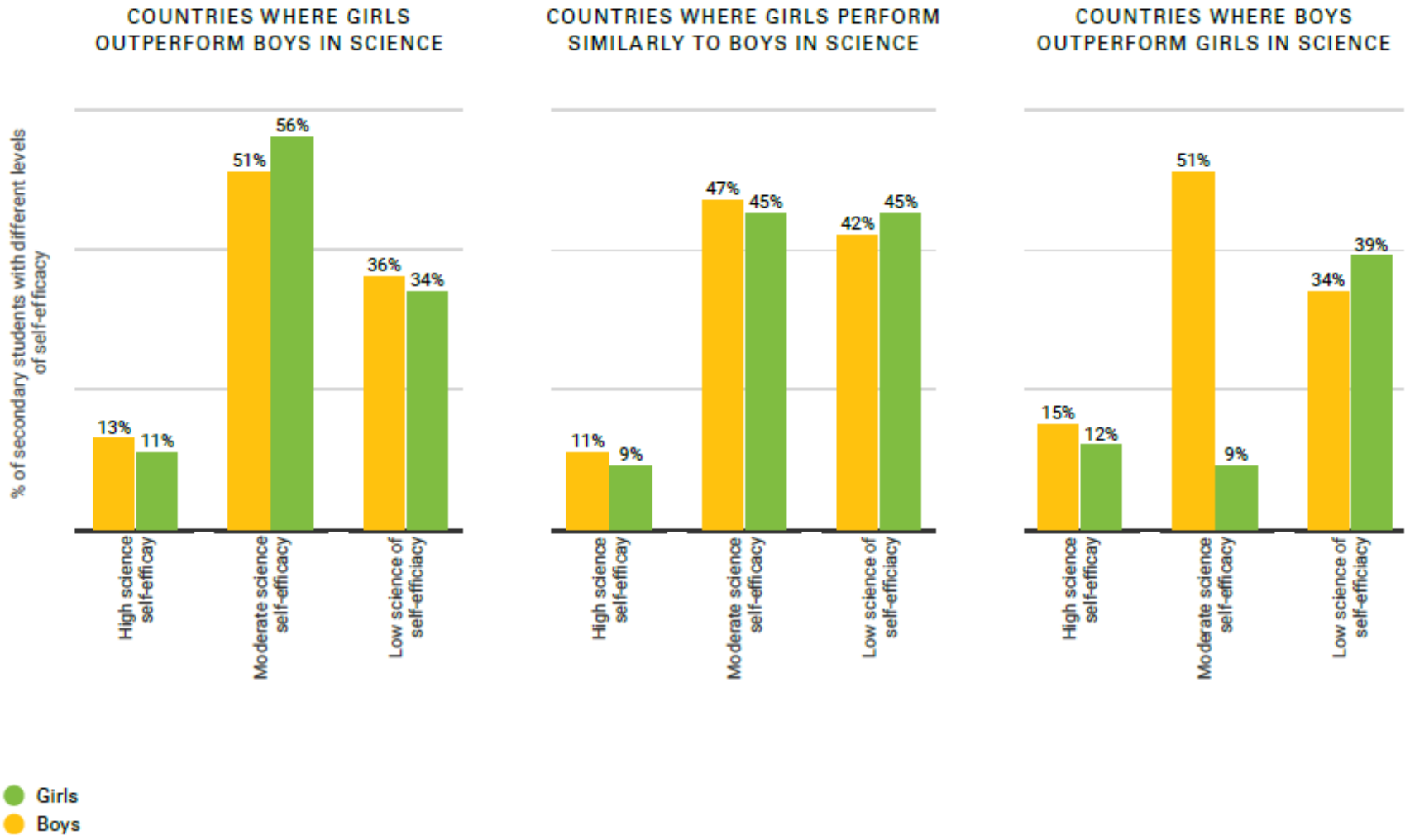
When girls do use the computer or internet, they exhibit similar cognitive and behavioural skills as boys…



… but when it comes to advanced digital skills, women lag behind men everywhere



Girls have lower self-confidence in their STEM abilities than boys in most countries[21]



Gender-responsive STEM education

is an approach to teaching and learning with the transformative potential to deliver on the promise of the girls' education and empowerment agenda in the 21st century.

AGENCY & VOICE

Strengthen their agency

CRITICAL UNDERSTANDING

Enable them to understand and seek solutions to issues in the world

LEARNING OUTCOMES

Motivate them to learn and achieve at the highest levels

TRANSITION TO EMPLOYMENT

Facilitate their transitions to employment and livelihoods

EMPOWERMENT

Empower them to be innovators, entrepreneurs, and changemakers

This approach challenges traditional views of men and women about what girls are able to do and what they can aspire to.

Why is STEM learning important for children and adolescents?

We cannot afford to live in a world where scientific and technological solutions are desperately needed – and exclude girls and children in rural locations – more than half of the world's talent.

STEM learning encourages children to think as innovators

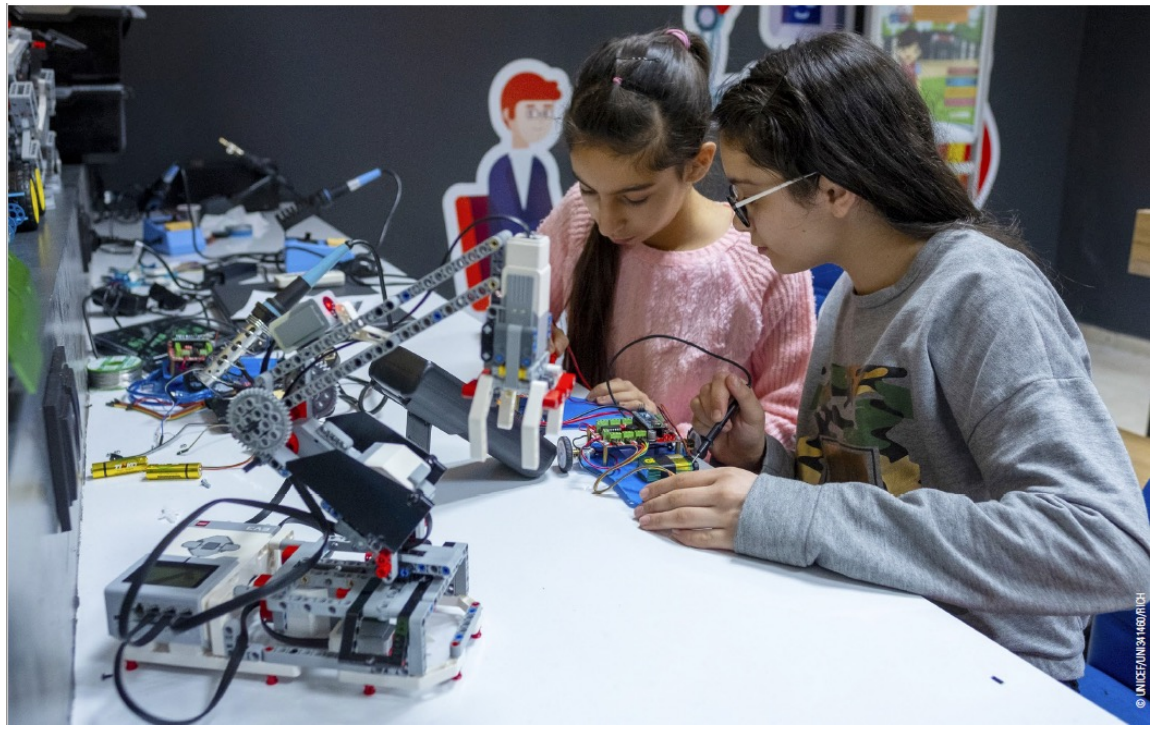
STEM learning can develop children's literacy and numeracy

STEM education grows transferrable skills

STEM education provides a foundation for children to apply digital literacy

STEM learning provides job-specific skills

STEM education disrupts unequal gender norms



Solutions featured in the report

1. Design innovation by Afghan girls to tackle Covid
2. Strengthening education system using STEM in low-income countries (UNESCO CapEd Uganda and Niger)
3. Preparing women for the STEM workforce (ILO)
4. The Little Adventurers: taking STEM to young girls (IADB – Carvajal Foundation – Sesame Workshop)
5. Advancing indigenous women in STEM: playing the long game (Australia)
6. UNICEF Bolivia: Tackling gender equality in STEM field with a multipronged approach
7. UNICEF EAPRO: Oky Period Tracker App For Girls
8. UNICEF Vietnam: Taking gender-responsive STEM education to scale

Results: Scaling up and integrating girls' empowerment, STEM and Digital Skills into national systems

- Pilot programs in 4 countries have transitioned from pilot to national scale implementation: Bangladesh, Bolivia, and Egypt.

- Skills4Girls programme is currently working with and for girls in 22 countries to bridge the gap between the skills girls need to be competitive in the 21st-century workforce, versus those they have traditionally had access to.

Example 3: Climate & Education

Climate Change is the greatest threat the world has ever faced

More than 1 billion children and young people are at extremely high risk

Action is needed – NOW

500% Increase (5x)

in the number of climate-related disasters over the last 50 years

58% of all deaths

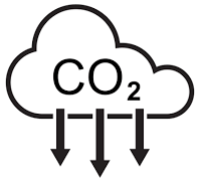
from disasters occur in the top 30 countries on the Fragile States Index.

6-20 years before too late

The threshold for dangerous global warming will likely be crossed between 2027 and 2042

$300 billion

Estimated total damage caused by disasters, including climate change induced Between 2012 and 2018,



To avoid the worst impacts of global warming, we must globally achieve net-zero carbon emissions **no later than 2050**.

Impact of Climate-induced shocks on education 2022

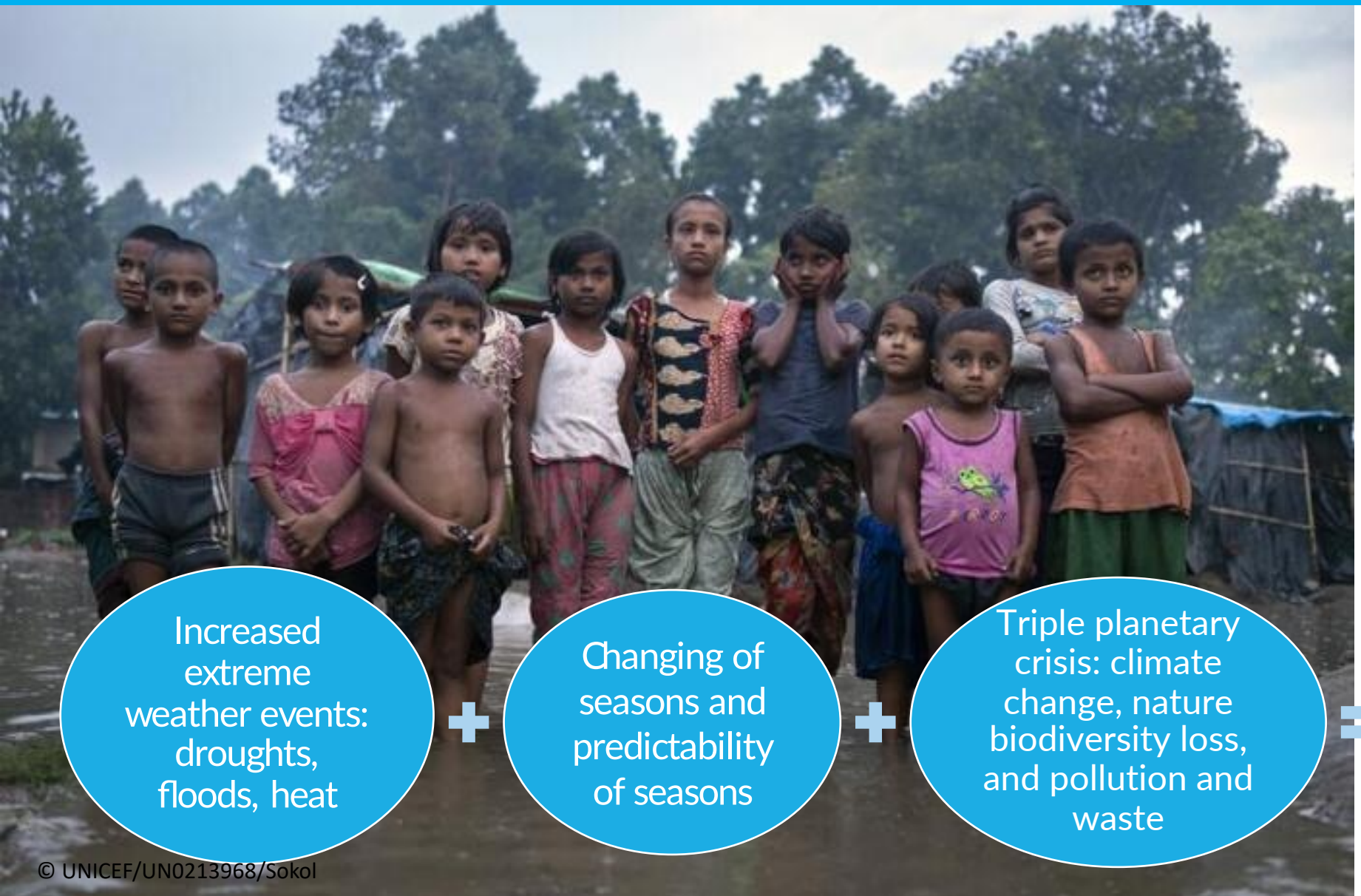
unicef
for every child

- Horn of Africa – worst drought on record communities on the brink of famine – 3.6M children at risk of dropping out.
- 19 countries across West Africa affected by severe floods.
- 1/3 of Pakistan underwater.

High risk of reversing development gains in education

  - disrupts learning
  - increases out of school children and dropouts
  - intensifies inter-generational poverty

Impact of Climate Change on Education Outcomes



Increased extreme weather events: droughts, floods, heat

+

Changing of seasons and predictability of seasons

+

Triple planetary crisis: climate change, nature biodiversity loss, and pollution and waste

=

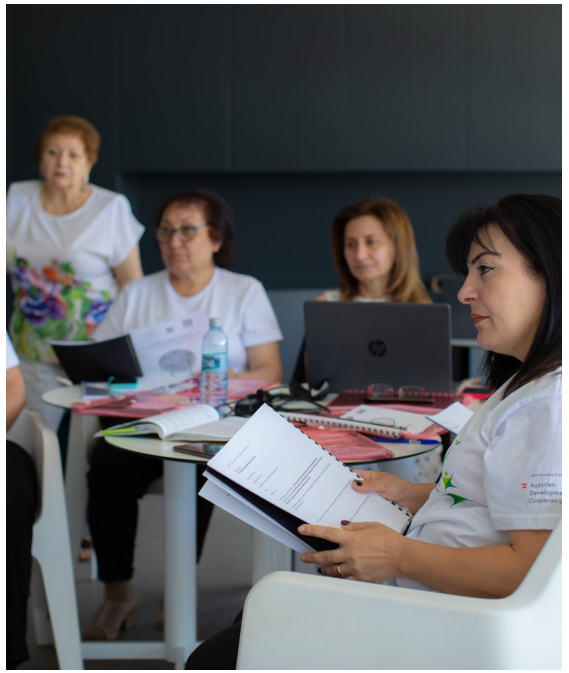
INDIRECT & DIRECT IMPACTS ON EDUCATION OUTCOMES

Increased budget needed

Increased vulnerability challenges resilience capacities at individual, community and national levels

Climate emergency intersects with poverty, gender, vulnerability, conflict

Transformative potential of education for Climate Change Adaptation and Resilience: UNICEF's approach



Greening Learning & Skills

Youth-led climate action

Greening capacities of systems

Greener and safer learning facilities

Education plays a crucial role for accelerating results. What percent of climate finance is invested in education?

a. 30%
b. 3%
c. 0.3%
d. 0.03%

104 countries

Participation of young people on climate, energy, environment, and/or disaster risk reduction initiatives including policy development, advocacy, or campaigning

unicef
for every child

63 countries

Support for integration of climate, energy, environment, and/or disaster risk reduction in education / green skills (curricular or non-curricular)

UNICEF's approach: EMPOWER every child through their life course with learning opportunities and skills to be a champion for the environment.

India, Bangladesh Cambodia, Armenia

Climate action integrated into curriculum and teacher education – students lead climate action projects. **More than 10 million children engaged.**

Kenya

Green Skills for young women to build agribusiness and promote circular local economies.

Burundi

Green Skills and STEM for adolescent girls to build clean energy stoves and conserving forests

Ecuador & Paraguay

Climate academy upskills emerging young leaders to engage in policy dialogue and implementation of environmental projects.

Mongolia

Volunteers measuring air quality and alert the community

$10M mobilized in the first 8 months of the initiative

Egypt

Decrease water usage in farming

Kazakhstan

Challenging the use of single use plastics

South Africa

Providing an early warning system on water quality

Lebanon

Setting up systems to turn biowaste into fuel

Thank you.

STEM and Digital Literacy