

Science Action for Sustainable Development in Secondary Schools in Ghana

P. Molnar¹, D. Molnar¹, A. Rittner¹, E. Dawoe²

¹Institute of Environmental Engineering, ETH Zurich (Switzerland) darcy.molnar@ifu.baug.ethz.ch

²Kwame Nkrumah University of Science and Technology Kumasi (Ghana)

Introduction

Science Action in Schools for Sustainable Development¹ (SAS4SD) is an education project which brings together expertise from Switzerland and Ghana to develop and implement teaching programs for secondary school science/environmental clubs that will, through interactive engagement, enhance students' understanding of scientific theory, data and applications, and at the same time raise awareness about global sustainable development goals and ways to achieve these goals in Africa.

From data collection to community initiatives

The project is developing educational material that is based on on-site observed climatic data from **TAHMO² stations** installed at schools across Ghana (Fig. 1), creating a direct link between measurements and actions (Fig. 2). The material addresses scientific and practical questions related to locally-relevant issues such as climate change, natural hazards, deforestation, and sustainable agriculture.



Fig. 1: TAHMO station in Ghana

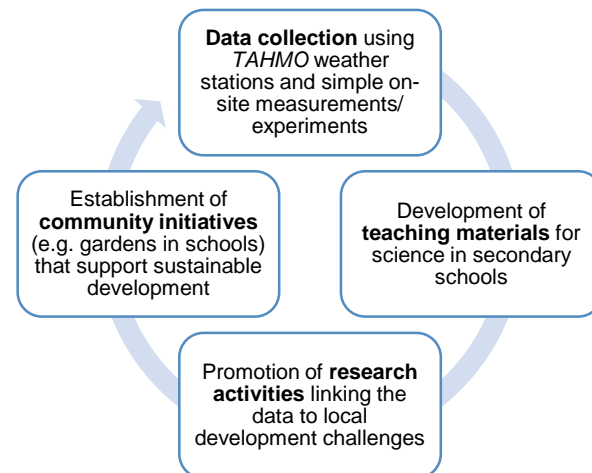


Fig. 2: The 4 pillars of the project

The teaching materials aim at explaining the connection between **physical processes in a local and a global context**: e.g. temperature and global warming, rainfall and the west African monsoon, evaporation and the water cycle, relative humidity and climate extremes, infiltration and land use change, erosion and biodiversity.

The teaching material addresses the following Sustainable Development Goals (SDGs): Zero Hunger, Quality Education, Clean Water and Sanitation, Responsible Consumption, Climate Action, and Life on Land.



Teaching material

A "Climate Change Adaptation and Mitigation" module that tackles current issues of globally and locally shifting weather patterns and causes and consequences thereof has been developed. The content focuses on existing educational concepts and introduces hands-on **learning through experiments**, exploring real-time weather data from TAHMO stations, concluding with proposals for concrete actions to mitigate or adapt to climate change. The 6 lessons of the module are:

- **TEMPERATURE & Global Warming**
- **PRECIPITATION & the West-African Monsoon**
- **EVAPORATION & the Water Cycle**
- **RELATIVE HUMIDITY & Climate Extremes**
- **INFILTRATION & Land Use Change**
- **EROSION & Biodiversity**

Each lesson in the "Climate Change Adaptation and Mitigation" module consists of the following five sessions:

1. **Topic:** An introduction to review existing background knowledge from science and geography classes and link it to current climate change phenomena. Examples include the topic of **global warming**, the **West-African monsoon**, and the **water cycle**.
2. **Variable:** A description of a selected climate variable or process, its unit and its measurement. This variable is relevant to understanding the introduced climate change topic. Examples of variables include **temperature**, **precipitation**, and **relative humidity**.
3. **Experiment:** A low-budget experiment to further investigate the climate variable and its physical, spatial and temporal dependencies. Students are introduced to scientific fieldwork and measuring. All necessary material is easily available in the local context. Examples include creating the **greenhouse effect in a PET bottle**, and building a **low budget rain and evaporation gauge**.
4. **Data Exploration:** An analysis of either TAHMO or self-measured time series data of the respective variable. Students are encouraged to develop ICT skills and draw **conclusions from scientific data**.
5. **Action** Concrete ideas to tackle climate change and implement actions at the school or community level are proposed. Actions (Fig. 3) include **rainwater harvesting**, **vegetable gardening**, and **waste management** to reduce stagnant pools where mosquitoes are likely to breed. Support for the implementation of actions is to be sought locally at administrations or NGOs.

The material takes into consideration the students' personal experiences in the context of climatic variables, and will be tested in two pilot schools in Ghana in 2019, before being distributed for wider use.

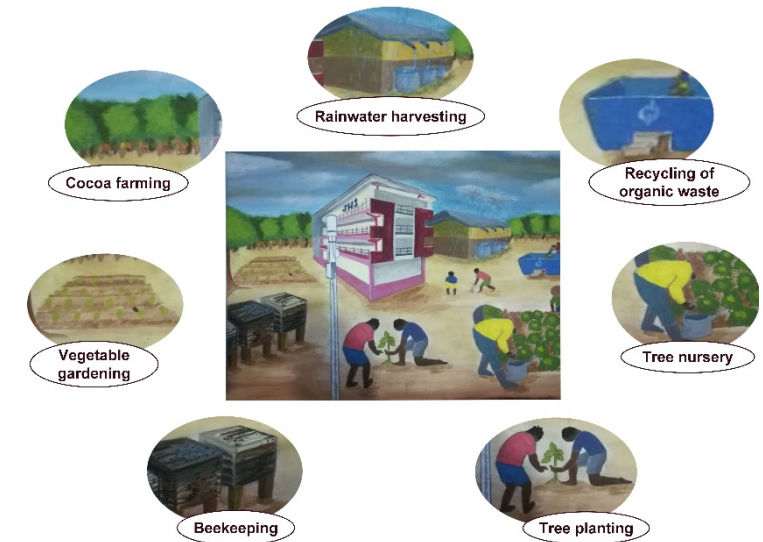


Fig. 3: A secondary school with a TAHMO station and proposed actions
Illustrator: Joshia Dekia

Outlook

The aim of the project is to enhance the **acceptance of science** by local communities through integration into the secondary school context – imparting the skills at an early age and encouraging students to become change-makers in their communities in Western Africa.

The teaching material will be introduced through after-school **science clubs** where learning can go hand in hand with experiments (Fig. 4), followed by concrete actions that are implemented on the school grounds (Fig. 5), and in collaboration with local communities. The Sustainable Development Goals (SDGs) are an integral part of the teaching material, creating a link between learning, local livelihoods, and global challenges.



Fig. 4: Pupils performing a low-budget experiment



Fig. 5: Pupils in Bibiani (Ghana) with TAHMO station on school grounds

References

¹Science Action in Schools for Sustainable Development (SAS4SD) <https://sas4sd.ethz.ch>

²Trans-African Hydro Meteorological Observatory (TAHMO) <https://tahmo.org/>