

**STEM and Open Schooling for Sustainability Education using the example of the
Horizon 2020 project MOST
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Introduction

Given the current global challenges, it is high time to act and learn how we can live together sustainably on our planet. To initiate such a movement, in 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development. At the core of it, there are 17 Sustainable Development Goals (SDGs). With these, all 193 member states of the UN have agreed on how to build a sustainable, peaceful, prosperous and equitable world society. However, this requires a profound transformation of the way we think and act. The key to this lies in comprehensive education for all. Therefore, SDG No 4: Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all has a key function in this transformation process: An appropriate education is not only a goal in itself, but also crucial in order to achieve all other goals.

Education for Sustainable Development

The principles of sustainability are to be anchored in education systems worldwide through Education for Sustainable Development (ESD): “ESD aims at developing competencies that empower individuals to reflect on their own actions, taking into account their current and future social, cultural, economic and environmental impacts, from a local and a global perspective. Individuals should also be empowered to act in complex situations in a sustainable manner, which may require them to strike out in new directions; and to participate in socio-political processes, moving their societies towards sustainable development.” (UNESCO, 2017, p. 7) Through ESD, learners can develop cross-cutting competencies such as collaboration competency, critical thinking competency, self-awareness competency and integrated problem-solving competency. These competencies are crucial to understand the increasingly complex and uncertain world in which they live and to deal with the current and future challenges of a rapidly changing environment: “People need to be able to collaborate, speak up and act for positive change”. (UNESCO, 2017, p. 10) Together with the key competencies, specific learning objectives of ESD must be pursued: Enabling learners to develop awareness and a critical and contextualised understanding of the 17 SDGs and motivating them to take action for sustainable development. Responsible action is what ultimately matters.

To achieve all this, ESD relies on an action-oriented, innovative pedagogy: All learners should be empowered to take responsibility for present and future generations and actively contribute to societal transformation. Participative teaching and learning methods which empower learners to act should be learner-centred and action-oriented. They should support transformative learning which means to question and change the ways, learners see and think about the world to deepen their understanding of it. This also requires a change in the role of the educators to one of being a facilitator of learning processes (Barth, 2015; MOST Pedagogical Guidelines, p. 16ff). It is also recommended that educators and educational institutions should foster partnerships at the local, national and international level to facilitate new ways of learning, integrating different perspectives and experiences: “In a dialogue or a project that includes cooperation with a partner in practice, students can learn about real-world

challenges and benefit from the partners' expertise and experiences. At the same time, partners too can be empowered and their capacity as critical agents of change can be increased" (UNESCO, 2017, p.59)

Open Schooling: An innovative method for STEM teaching and learning

Education for Sustainability Development has become an essential part of the international STEM curricula and brought along many transformations of teaching and learning. A participative educational approach which has proved to be successful in providing learners from different backgrounds with the STEM learning experiences mentioned above is Open Schooling: The idea behind Open Schooling is to create new partnerships between schools and their communities. Their purpose is the creation of learning spaces accessible for all citizens to join and let society learn with, about, and from each other: "Open Schooling (is) where schools, in cooperation with other stakeholders, become agents of community well-being; families are encouraged to become real partners in school life and activities; professionals from enterprise, civil and wider society are actively involved in bringing real-life projects into the classroom." (Science for Responsible Citizenship, European Commission).

Experiences from the Open Schooling project MOST (2020-2023)

The EU-funded project MOST (Meaningful Open Schooling Connects Schools to Communities) intended to support students and citizens in Europe to develop scientific knowledge, transversal skills and competences in working scientifically. The project opens up formal STEM education to the citizens and establishes partnerships between schools and their communities to work scientifically together as equal partners on school-community projects (SCP). In an SCP, students work with members of the community (family, academic or non-formal education providers, NGOs, businesses, etc.) on an environmental problem that directly affects their community. Jointly they develop regionally feasible solution approaches. The acquired knowledge will then be delivered to the community. The sharing of results can be accomplished through all sorts of measures such as short video clips, pictures, posters, flyers, newspaper articles.

Over a two-year period, 672 SCPs were implemented across ten European countries. In total, 78,974 participants were involved of which 23,113 were students, 2,443 teachers and 53,418 community members. The projects vary in length and group size. But what they all have in common is that they have tried to deal with an environmental issue in real-life contexts by working together with external stakeholders and looking for solutions on how to deal with it.

In all projects, it became obvious from participants' observations and as part of the project evaluation that SCPs build and nurture key competencies.

Working together in their project groups, the participants have developed considerable collaboration competencies. An essential part of the project design was a co-creation process where students and teachers collaborated with experts, scientists, parents and citizens as equal partners and with shared responsibilities on a common challenge. In some cases, these SCPs even inspired further projects at the same or other (school) communities. Thus, the participants were also able to share their experiences in collaborations, becoming mentors or ambassadors for their projects by providing collaborative support.

Moreover, MOST showed that SCPs increase the participants' integrated problem-solving competency. All projects focused on real-life contexts and dealt with questions relevant to them as a group or to the whole (school) community. Dealing with those authentic questions in an inquiry-based learning setting automatically meant that results were open and unpredictable or unexpected challenges had to be overcome as part of the scientific process, individually or and as a group. Due to the meaningfulness and relevance of the chosen topics and tasks, a high level of motivation could be perceived, which positively influenced integrated problem-solving

competencies. Moreover, the participants' different backgrounds lead to a multi-perspectivity and interdisciplinarity, which also enriched the problem-solving process.

Another essential competency nurtured through MOST was critical thinking. In their projects, all participants actively discussed current issues in the field of sustainability and acquired new STEM and general knowledge. Jointly they debated various perspectives the different partners could provide, covering scientific, socio-political, economic, environmental or psychological impacts of their project topics. Ultimately this type of project design does not only raise people's awareness for sustainability, but also develops their communicating, decision-making and negotiating skills. It may even sharpen their values and lead them to questioning traditional ways and perspectives. Therefore, encouraging critical thinking also becomes a vital component in the promotion of democracy.

Another interesting observation is that the MOST projects also supported self-awareness competencies. In the course of the SCPs, participants have become aware of their own skills, values and desires and they could discover their own talents and passions. There was also space for the participants to try out new roles - for example, adults learning from students; or for adults to take students' ideas and thoughts seriously. Moreover, SCPs were safe spaces where mistakes became learning opportunities instead of flaws and where non-stereotypical gender representations were offered. In general, participants had time to reflect on their own actions and learned for example how good it feels to make a difference together, even if it is only on a smaller scale at first.

Overall, the development of these four competencies within the MOST project clearly lead to the achievement of the specific learning objectives of ESD mentioned at the beginning:

Participants gained an overall awareness for Sustainable Development through their new (STEM) knowledge and increasingly understood environmental processes. They have learned that there are no easy solutions, but that many factors, perspectives and influences have to be taken into account in order to move forward. This also includes making mistakes, going in the wrong direction, and then coming back and starting over again. However, it also became clear to many participants that this new awareness comes along with a new responsibility to take action as well. This last step has proven to be significant in order to counteract students' frustration and hopelessness e.g. about the current state of the environment or the way politics are dealing with it. Participants can experience themselves as a community that finds solutions to a difficult situation together. Therefore the main goal of Open Schooling often comes as a relief and also as a guide for action: To look for real-life problems and find practical solutions allows for a positive take-away for the project participants. They can really achieve something for the whole (school) community, they have changed something for the better or at least they have tried to do something instead of waiting around. In this way, the participants directly experience that their actions have an effect. Because in the end, it is all about making a difference, even if it is only a small scale. But also about the knowledge that we can make great changes if many people in many places take small steps.

And this exact feeling of empowerment can manifest itself in several ways. The participants felt empowered to:

- act and respond to complex situations and challenges
- to overcome their own shortcomings, fears, insecurities, worries (sometimes as part of a shared group experience)
- to shape their own future

Eventually, this specific type of open schooling experience can affect whole communities on various levels and can empower all participants from students to teachers or citizens to transform existing structures, thus making them significant agents of change in terms of educational transformation, responsible (environmental) citizenship and community-wellbeing.

Summary

Education for Sustainable Development “asks for an action-oriented, transformative pedagogy, which supports self-directed learning, participation and collaboration, problem-orientation, inter- and transdisciplinarity and the linking of formal and informal learning”. (UNESCO, 2017, p. 11) The MOST project has taught us that this is exactly what Open Schooling can offer. Therefore, it represents a great illustration of modern quality education in the way it is proposed by the SDGs and also a concept that is worth spreading amongst educators across Europe.

Inspiring best practice examples of MOST School-Community projects can be found here:



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