

Making school science relevant to real-world challenges through Open Schooling Science learning projects

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The MULTIPLIERS project aims to expand opportunities for science learning by fostering collaboration between students, schools, families, local communities, civil society organizations, informal learning providers, universities, the media, policy makers and industry. Here we provide information on how in Open Science Communities (OSCs) that have been established in the project countries—Germany, Cyprus, Spain, Slovenia, Sweden and Italy—collaboration and authentic science learning can be fostered. [GreenComp](#), the European sustainability competence framework, published in 2022, highlights the importance of encouraging learners to act at individual and collective level to shape sustainable futures. This demands teachers, schools and policy makers to make change happen. A plethora of stakeholders at local level must work together to shape and achieve global transformations for a more sustainable planet. OSCs provide local communities with a space for open, inclusive and inquiry-based learning on science issues that have an impact on citizens' lives.

In each OSC, open-schooling science (OSS) learning projects were developed collaboratively with science professionals to bring real-life cases to the students regarding contemporary challenges/ socio-scientific issues. Students collaborated

with several stakeholders to explore different perspectives and improve their understanding while being involved in scientific practices (e.g., problem-based activities, collecting and analysing data, modelling, argumentation). Having gained first-hand experiences and an insight into inquiry-oriented practices in authentic learning environments, students became knowledge multipliers; they presented and shared their knowledge and experiences in multiplying activities by actively involving their families and the wider community, through dedicated local events (e.g., open-school/local action days, citizen science activities), and through designing and exploiting science communication media (e.g., exhibitions, social media channels, and video clips).

Hundreds of students and teachers took part in science learning projects, including exploring ecosystems with our natural science backpacks in Slovenia, monitoring air pollution data in Spain, raising awareness about Antimicrobial Resistance in Cyprus, discussing how to influence political decisions about forests in Sweden, discussing ethical aspects of vaccination in Germany, and conducting a blind water tasting in Italy.



MULTIPLIERS Open Schooling Science Learning Framework

The different phases of MULTIPLIERS Teaching and Learning sequence

The theoretically and empirically rooted conceptualisation of Open Schooling guided the formulation of the framework consisting of design principles for developing and enacting a Teaching and Learning Sequence (TLS). The MULTIPLIERS framework evolves in three phases as follows:

Phase 1. Identification and exploration of socio-scientific issues (SSIs) of relevance to the local community

This is the preparation phase in which the teaching and learning activities are developed in collaboration with teachers, students and the wider OSC network. Teaching is oriented towards the socio-scientific topics to raise awareness of the issue(s), to foster students' interest in science, their self-efficacy in learning science and their science career awareness, as well as to develop relevant competences (e.g. argumentation, critical thinking) and to organize the OSS learning project.

Phase 2: Engagement in the open-school science (OSS) learning project

In this phase, students explore the SSI relevant to the local community, engage in the

OSS learning project to address the selected SSI, elaborate on the local challenges to be addressed, and collaborate with OSC members to co-create solutions and build knowledge based on sustained inquiry. Students are actively engaged in authentic activities and scientific practices by interacting with experts in school and out-of-school settings. They learn about different perspectives, engage in decision-making processes and use evidence in their argumentation.

Phase 3. Students acting as multipliers

In the final phase, the students act as multipliers, passing on their knowledge and communicating science to a wider audience through open schooling events (e.g. science fairs, poster exhibitions, community debates, video clips).

The MULTIPLIERS open schooling science learning framework covers all the educational activities that take place before, during and after the implementation of OSS learning projects. It is important to note that the duration of the teaching and learning sequences can vary from a few weeks to several months, depending on the OSS learning project, the flexibility of the stakeholders involved, the school curriculum, the timetable and the school organisation in general. MULTIPLIERS project has shown that teachers and schools in different countries have successfully adapted the framework to their local conditions. This is a key message regarding the flexibility and applicability of the teaching and learning approach in different national and regional contexts.

Active participation of students

The active participation of students is a main feature in this collaboration. Students engage in scientific practices and develop their OSS learning projects in collaboration with their teachers and science experts in an authentic environment (MULTIPLIERS Phases 1 and 2) and organise different types of open schooling events to share their projects and knowledge with their families and the wider community (Phase 3). In this phase, the students act as knowledge multipliers and are supported by the OSC members raising awareness on the socio-scientific topic to a wider audience within their community.

Conclusion

The MULTIPLIERS project offers insights to inform the design of open-schooling teaching and learning activities providing practical recommendations for curriculum design and classroom practices to enrich the curricula and pedagogical approaches in school science. We demonstrated that collaboration within the OSCs, along with the focus on active student involvement and participation, enhances the potential of school science education by broadening its scope to address socially relevant issues. This approach not only enhances students' interest in science and awareness about science careers, but also strengthens their critical thinking and argumentation skills, preparing them to engage with complex societal challenges more effectively.

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