



# LOESS

LITERACY BOOST THROUGH AN OPERATIONAL EDUCATIONAL  
ECOSYSTEM OF SOCIETAL ACTORS ON SOIL HEALTH



## **Blueprint for exemplary sustainable practices in educational setting**

**Subtask 3.2.3**



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## 1. A blueprint for exemplary sustainable practices

The LOESS Blueprint is intended for educators at various levels who are interested in integrating soil health topics into their teaching. In addition to outlining the importance of incorporating soil-related content into education, the Blueprint introduces the 5E instructional model (Bybee et al, 2006), which serves as a guiding framework for designing educational programs that have the potential to lead to deep learning and exemplary sustainable practices.

It offers a structured, research-based approach to fostering soil literacy through engaging and effective teaching strategies. Grounded in constructivist pedagogy and aligned with European policy objectives, the Blueprint functions both as a practical guide and a source of inspiration for developing impactful, sustainability-oriented educational experiences. The document concludes with case studies from selected LOESS partners, illustrating exemplary practices in diverse educational settings.

### 1.1 Description of the Blueprint

The educational objectives of establishing soil literacy and introducing the concept of soil health in Europe are central to the European Green Deal. They are also critical to realizing the EU's long-term vision for sustainable rural development and meeting the targets set out in the EU Soil Strategy for 2030. Achieving these ambitions requires a strong educational foundation: integrating soil-related topics into primary, secondary, and tertiary curricula is essential. Such integration offers students at all levels immersive learning experiences that spark curiosity and nurture a deeper sense of environmental responsibility.

However, realizing this vision is not without challenges. As Hartemink et al. (2014) highlighted, a growing gap exists between advances in soil science research and what is taught in schools — particularly at the undergraduate level. This blueprint directly addresses that gap by promoting student engagement and strengthening conceptual understanding through the 5E instructional model developed by Bybee et al. (2006). Drawing on a range of 20th-century educational theories, the 5E model provides a structured framework that fosters inquiry, motivation, and meaningful learning, making complex scientific concepts more accessible and relevant in educational settings.

#### Target audience

This blueprint is intended primarily for those who educate pre- and in-service teachers, as well as educators working in institutions that support learning outside the classroom. However, it can also serve as a practical framework for teachers at the pre-primary,



primary, and secondary levels. It is designed to support anyone interested in developing and implementing research-based teaching units – both in general and specifically focused on soil and soil health – within their existing educational practice.

The blueprint includes a variety of [exemplary sustainable practices](#)<sup>1</sup> aligned with clearly defined learning goals, organized into five complementary phases. Each practice is easily adaptable to different age groups, allowing for flexible integration across educational contexts.

### Purpose and intended use

The content of soil education programs varies across European countries due to differences in educational systems and national priorities. Nevertheless, there is a growing trend toward integrating soil-related topics into school curricula. As van der Putten et al. (2018: 28) note, there is a pressing “need for educational programmes that create awareness of the role of soil in the life of individuals, communities and European society as a whole.” The desk research (sub task 2.2.2), conducted at the beginning of the project, revealed that teaching materials on soil health education were often linked to other, seemingly overarching topics. For example, in Austria, soil was typically addressed either in the context of forest soils or closely associated with agricultural productivity.

Despite progress in some countries, the implementation of comprehensive soil health education across Europe remains uneven. A key challenge lies in the lack of consistent approaches to teaching soil science across regions and educational frameworks. Additionally, the degree of emphasis placed on soil education varies significantly, with some regions prioritizing it more than others. This inconsistency highlights the need for increased collaboration and coordination at the European level to promote soil literacy and raise awareness among both students and educators.

LOESS addresses these challenges by proposing this blueprint for sustainable and exemplary practices in soil education and follows the goal to raise awareness on soil health topics as well as improving soil literacy in society. The blueprint builds on insights gained from earlier project stages, such as the desk research and interviews (sub task 2.2.2) conducted in Work Package 2. Its current structure and content were shaped through a co-design workshop (T3.2) involving stakeholders with expertise in diverse educational and scientific fields who agreed on making use of the 5E model.

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<sup>1</sup> The list of exemplary sustainable practices was compiled with the support of several LOESS partners as well as the [EduGlobalSTEM group](#) and [INS Escola Freixes](#). Link to the list of practices is included in annex.



## Key components of the blueprint

The objective of the LOESS Blueprint is to intertwine up-to-date soil research knowledge and education research-based strategies, and to enhance soil literacy education in Europe. Thus, the blueprint presents the LOESS teaching and learning framework that is based on the 5E model by Bybee and colleagues (2006). Following this model will support educators in outlining clear learning objectives regarding soil health education. The blueprint aims to emphasize both conceptual understanding and environmental awareness and is designed to offer examples that are adaptable to different classroom settings and age groups.

The BSCS 5E model is illustrated through selected examples of classroom activities and learning scenarios. These scenarios were co-designed by educators and researchers across Europe and reflect the diversity of approaches needed to address local and regional challenges in soil health education.

To encourage its implementation, the blueprint includes a collection of case studies from LOESS partner institutions. These case studies demonstrate how the instructional model can be successfully applied in real-world contexts, highlighting both opportunities and challenges encountered by educators during this process. They also serve as a source of inspiration and provide concrete examples that other educators can adapt and replicate.

## Instructional model: the 5E framework

The 5-phase approach is already well tested and there are several studies proving its effectiveness when following the scheme (Koyunlu Ünlü & Dökme, 2022). The model is based on the idea of constructivist learning and aims to give learners the opportunity to deeply understand the subject matter via different learning activities and first-hand experience. The goal is to engage students in creative thinking and putting their ideas into practice. Planning in advance is crucial for implementing the individual phases.

While the phases do not need to be followed in a particular order it is important to include each one, as they complement and support one another. The time allocated could vary depending on the overall time available. The planning supports educators to understand when it is time to evaluate a specific task or when it is helpful to pose supportive questions or give further scaffolds as this will support students to develop their higher-order thinking skills (Alrawili, 2020).

Research in the recent decade of Inquiry Based Science Education (IBSE) brought us profound knowledge about how to scaffold good science learning. Thus, the blueprint will give examples on how to support learners to learn most effectively.



The 5E instructional model consists of five distinct phases which complement each other and therefore offer different learning goals to achieve. By designing educational programs accordingly, the teacher or educator creates a motivating and learning-intensive program that not only engages students physically but also promotes deep learning. The joint effects of hands-on and minds-on learning enable children with different needs to learn successfully. The LOESS blueprint describes these 5 Phases taking the Soil Health concept into consideration i.e.:

- **Engage** – This phase aims to spark students' interest in a particular soil topic and to assess students' prior knowledge and pre-existing ideas. LOESS activities begin with exciting elements like hands-on experiments, puzzling phenomena, concept cartoons, videos, or soil mysteries.
- **Explore** – In this phase, students explore aspects of a given issue through activities designed by teachers, allowing them to test ideas, solve problems, and acquire background knowledge. The goal is to enhance students' preconceptions and support cognitive processes through precise questioning and student-centred activities.
- **Explain** – In this phase, students explain their new understanding of a soil phenomenon and connect it with prior knowledge using mind maps, presentations, role plays, and posters. Teachers provide feedback to address misconceptions and support students in using scientific language accurately. Additionally, teachers may offer explanations to guide students toward a deeper understanding.
- **Extend** – In this phase, students deepen their understanding of soil-related phenomena and practice newly acquired skills by applying their knowledge to new and related contexts. It encourages them to develop strategies for using these skills independently, make informed decisions, and take meaningful action. This phase fosters creativity and promotes the application of knowledge to real-world challenges.
- **Evaluate** – This phase is a critical component of effective LOESS teaching. While student-centred and hands-on activities are highly engaging, they can result in a high cognitive load and may not always lead to systematic knowledge building. To address this, formative assessment plays a vital role in monitoring learning, providing timely feedback, and guiding instructional support. In parallel, summative assessment at the end of the learning process ensures a comprehensive evaluation of students' knowledge and skill acquisition.

### **Development process**

The LOESS Blueprint was developed through a collaborative and iterative process involving educators, researchers, and stakeholders from multiple European countries. The



**development began with a review of existing literature and policy documents, followed by the identification of educational needs through curriculum analysis and stakeholder engagement. The participatory approach ensures that the blueprint is grounded in both educational theory and classroom practice, while remaining adaptable to a wide range of contexts.**



## 2. References

**Alrawili, K. S., Osman, K., & Almontasheri, S. (2020). Effect of Scaffolding Strategies on Higher-Order Thinking Skills in Science Classroom. Journal of Baltic Science Education, 19(5), 718-729.**

**Bybee, R. W., Taylor, J. A., Gardner, A., Van Scotter, P., Powell, J. C., Westbrook, A., & Landes, N. (2006). The BSCS 5E instructional model: Origins and effectiveness. Colorado Springs, Co: BSCS, 5 (88-98).**

**Hartemink, A. E., Balks, M. R., Chen, Z. S., Drohan, P., Field, D. J., Krasilnikov, P., ... & Walter, C. (2014). The joy of teaching soil science. Geoderma, 217, 1-9.**

**Koyunlu Ünlü, Z., & Dökme, İ. (2022). A systematic review of 5E model in science education: proposing a skill-based STEM instructional model within the 21st century skills. International Journal of Science Education, 44(13), 2110-2130.**

**van der Putten, et al., (2018). Opportunities for soil sustainability in Europe. (EASAC policy report; No. 36).**



### 3. Annex

- LOESS [exemplary sustainable practices](#) based on the 5E model

