STEAM LEARNING ECOLOGIES

SLEs Guidelines for SLEs initiators & partners

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Contents

Introduction

Purpose of SLEs Guidelines

The SLEs Guidelines is created to support and guide SLEs initiators in the implementation of the SLEs project in their respective countries. This document provides steps to planning an SLE, ways to support stakeholders, and tips to handling issues such as data collection. It also provides important resources that will be useful throuhgout the project implementation.

The Pilot Guidelines are based on the SLEs Methodology –revised after the conclusion of the pilot phase in august 2024.

After the SLEs pilot cycle, where 13 initiators tested and implemented the methodology, the project is ready for its scale-up phase, welcoming 100 SLEs. The SLEs mature phase will be carefully designed by the SLEs initiators and their stakeholders, with guidance and support from SLEs National Coordinators. This phase aims to bring together stakeholders from formal education, non-formal/inform education, local communities/civil society/ NGOs, with the mission of engaging in meaningful STEAM education in an open-schooling environment. The mature phase also aims to test and confirm all scenarios and hypothesis which emerged after the pilot implementation.

The feedback and results from the mature phase will inform the final version of the methodology and provide the insights on the policy change that could support the broader diffusion of Open Schooling and the Living Labs methodology for science education across Europe.

Roles and responsibilities

Throughout the SLEs project, each actor assumes a unique role and a set of responsibilities. The project involves three key actors: SLEs National Coordinators, initiators, and stakeholders.

National Coordinators

Project partners are acting as National Coordinators and are responsible for the pilot implementation in each country. Table 1 provides a list of the SLEs National Coordinators.

The SLEs Consortium, through the National Coordinators, actively supports the local SLEs to co-define the visions, thematic foci, action plans, concrete activities, tools, etc. for their development.

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SLE Initiators

The actor that initiates and implements an SLE in their respective country is the **SLE Initiato**r. While the school is the most common initiator of an SLE, the various stakeholders within an SLE can decide who initiates it based on the educational goals of the specific SLE. It is crucial that schoolteachers have a key role and input in designing the SLE and a bottom-up approach is guaranteed.

The SLE Initiator's responsibilities include:

- Generating or leading the generation of the SLE idea.
- Finding and connecting with the relevant stakeholders.
- Organising and coordinating activities and workshops (co-creation and regular catch-up meetings) as part of the SLE.
- Collaborating with stakeholders to decide on learning resources to be used.
- Analysing and collecting **learning resources** from the stakeholders involved in the SLE.
- Supervising the creation of **learning artefacts** by students and collect them.
- Collecting feedback from students and stakeholders involved.

The SLE Initiators are expected to share their observations, the learning artefacts and feedback with the National Coordinator. The National Coordinator then shares these key findings with the Consortium

The National Coordinators support the SLEs Initiator in the implementation of their SLE by guiding and mentoring them.

Stakeholders

Stakeholders are collaborative partners in the SLE project, crucial for planning and implementing their SLEs during the mature phase. These partners could be schools, universities, science centers, museums, research centers, industry partners, NGOs etc. They work alongside SLE Initiators and National Coordinators, provide resources, contribute to the design of activities and actively engage in the SLE activities.

Timeline of tasks for mature cycle

To facilitate the planning of the new SLEs and to ensure that they cover all steps of the SLE design and implementation, a suggested timeline is provided below. September is dedicated to learning about the SLE methodology through extensive reading of the shared materials (such as these guidelines) and by attending a series of national and international workshops, where experiences from the previous pilots will give initiators the chance to gain concrete tips and experiences to plan for their own projects. This is also when a generic project idea is identified. Between September and October, initiators should reach out to and recruit stakeholders relevant to their project and engage them in co-creation activities for the design of the SLE, its resources and its learning paths, by December. Between January and April all activities should be implemented with students, and by the end of May all project outputs and reports are expected. Depending on the SLE, its aims and the planned activities, **the timeline can be altered while the duration of the phases can be adapted**. Initiators should inform their national coordinators of such changes, so to allow them to tailor their support and adapt their reporting expectations.

Expected timeline

Attending workshops Defining your SLEs idea	Building partnerships	Co-creating your SLEs	Implementing all project activities	Reporting
September	October	December	April	May

Workshops in preparation for pilots

To prepare for the pilot cycle, the National coordinators, SLEs Initiators and stakeholders are invited to workshops that will help them better understand the project and their roles while they will also focus on various implementation aspects.

Developing your SLE

The development and implementation process of SLEs is based on the D2.2 SLEs Methodology first version[1]. Based on the feedback collected during the pilot cycle, this first version of the methodology was further refined and updated: **you can find it here**[2].

Step 1: Initiation and Getting Started

Once an SLE Initiator is identified, the National Coordinator plays a crucial role in guiding them through the SLE project. This involves helping the Initiator understand key concepts such as ecologies and co-creation, as well as clarifying the project's overall goals. The National Coordinator also assists the Initiator in taking the initial steps of the SLE design and supports them through the implementation process.

Identifying an idea or problem with learners

Based on the schools as living labs methodology[3], and with the support of National Coordinators, initiators will develop an idea or identify a real-life problem that they want to address with their SLE (step 1: co-creation). Involving learners in the process is highly recommended, as their active participation enhances their engagement and enriches the design process. SLE Initiators can use a combination of existent curriculum, current events, local issues and the interest areas of learners to facilitate the identification of a suitable idea for the SLE. Find the main ideas at the centre of the pilot SLEs that took place between September 2023 and April 2024 in this portfolio.

Below we include a list of key indicative questions to consider in advance and think about thoroughly which can assist the successful completion of this step.

- What do we find bothering or problematic in our everyday life?
- What possible solutions can we think of to improve it?
- What is feasible or what we can do to address the challenge identified?
- Has any idea or solution been tried before?
- Can we think of a new or improved one?
- What are the issues and needs of our community at local/regional level?
- What is community well-being? How is affected? How can we impact it?

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[1] **https://www.steamecologies.eu/wp-content/uploads/2023/07/SLEs-methodology.pdf**

[2] https://www.steamecologies.eu/wp-content/uploads/2024/09/D2.2_SLEs_Methodology-Updated-Version_v3_streamlined.pdf

[3] https://www.schoolsaslivinglabs.eu/wp-content/uploads/2021/09/The_SALL_Methodology_lilght.pdf

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- What are the societal challenges we are interested in or we are aware of?
- What do we find interesting to be engaged with?
- From a list of problems or challenges we have identified which one is worth tackling first?

Curriculum Integration

Initiators must ensure that their SLE is carefully integrated into the school's curriculum in the following ways:

- Initiators must integrate the STE(A)M aspect of the SLEs. This entails including at least **2 STEM or 1 STEM and 1 non-STEM subject** as integral parts of the pilot SLE.
- The SLE project idea should be aligned with the school/country established curriculum. To achieve this, the Initiator can communicate their idea with the Head of School and relevant teachers ensuring that the SLE pilot becomes a part of the curriculum planning or an additional project. Aligning the SLE pilot with the curriculum would benefit both the students and school, while ensuring parental support. This alignment enhances the school curriculum, while enriching the students' learning experience.

Securing necessary permissions and approvals

Initiators are responsible for securing the necessary permissions and approvals to implement their SLE, and for reaching out to their respective National Coordinator in case they require assistance. The initiators may have to secure permission from the following actors/stakeholders during the pilot phase:

Head of School and school council: The Initiator will describe the pilot and its objectives in a clear way to ensure that the Head of School and the school council (if needed) is well-informed of the activities planned and integrate it in the school educational planning. National Coordinators can help in framing this description and in providing more information on the SLEs project and its overall ambition.

Parents: National Coordinators can guide the Initiators to prepare a letter in case parents' consent is needed for students' field trips / interactions with other stakeholders.

Museums/Universities/other institutions: Initiators must ensure that they have written permission from Museums/Universities or other institutions for on-site visits. If Initiators are interested in taking photographs/videos at these locations, they must have prior permission from the institution.

Step 2: Preparation and Establishment of Partnership:

The next step is for SLE Initiators to identify potential partners and stakeholders and establish a meaningful relationship with them.

How to identify stakeholders

- Initiators can start by listing all possible stakeholders that relate to their SLE idea: For example, if the SLE is on food waste, the initiator can think about words related to the subject area (e.g., soil, worms, food waste) and then connect those with experts and/or companies that relate to them (e.g., composting, gardener, soil scientist).
- SLE stakeholders should be identified not only for their relevance to the project but also for the learning resources they can contribute and the STE(A)M career guidance they can offer to students.
- SLE initiators can use their immediate networks such as neighbors, students' parents, local and school communities to find possible partners.

- National coordinators can help identify specialist interest and sector organisations in the community and introduce the initiators to industry members. Face to face matchmaking opportunities or small events can also help on this aspect.
- It is important to try and identify external stakeholders that will benefit students such as local government bodies, industry or relevant NGOs. Such stakeholders will help create a far-reaching SLE.
- National Coordinators can meet with SLE initiators to draw up a set of criteria for identifying stakeholders and brainstorm with them on who are the most suitable candidates. The criteria depend on the topic, school curriculum, time constraints, the stakeholders' availability, and approachability.
- Once a shortlist is made, initiators can get in touch with the selected stakeholders.

Below we include a list of key indicative questions to consider in advance and think about thoroughly which can assist you in the search for stakeholders.

- Who has direct or indirect interest or motivation to participate?
- Who will be impacted, positively or negatively?
- Who will be affected directly or indirectly?
- Who will be benefited?
- Who do we need?
- Who do we know? Who is already in our network of contacts that could make a useful contribution, have interest to participate or introduce/recommend potential partners?
- Who has already been part of a similar project about the issue/problem/idea we have chosen?
- What knowledge, experience or authority is needed?
- Who within our local community or contacts could possibly have similar knowledge, experience or authority?
- With whom have we collaborated in the past?
- What is the level of their availability of learning resources?
- What is their willingness and ability to provide support to learners along their learning pathways?
- What role do we envisage for each potential partner?

How to approach stakeholders

- National coordinators should share email/message templates with SLE initiators that they can use to communicate with potential stakeholders consisting of a clear description of the SLE pilot idea, what they need from the stakeholders etc. A template of such an email is provided at *Annex 1: email draft to reach out to stakeholders.*
- We encourage Initiators to inspire potential stakeholders by presenting their idea in a simple and effective way, explaining what the stakeholders might gain from this experience and how it will benefit students and the community.

Potential challenges of working with stakeholders

While it can be a unique opportunity to work with stakeholders, it comes with its challenges. Over the course of the pilot, National Coordinators and SLE Initiators may encounter the following challenges when working with stakeholders:

- **Misalignment of Objectives:** One significant challenge can arise when the objectives of SLE stakeholders do not align with those of the SLE Initiator. For instance, stakeholders may prioritize different educational outcomes or have divergent expectations for the pilot. This misalignment can result in conflicts and misunderstandings, potentially hindering the successful implementation of the pilot.
- **Ethical Concerns:** Collaborations with external stakeholders may raise ethical questions. There can be concerns about the influence of these partners on the school curriculum, with potential accusations that they are attempting to shape education primarily to serve their business interests. Balancing educational objectives with external partnerships can be a delicate ethical challenge.
- **Quality Control:** SLE stakeholders may have varying quality standards and timelines for the activities they are involved in. These differences can impact the planned activities within the pilot, potentially leading to variations in the quality of the educational experience offered to students.
- **Conflict of Interest:** Given the diverse interests of stakeholders involved in the pilot, there is a potential for conflicts of interest to emerge. This can occur when the objectives or interests of one stakeholder group conflict with those of another, creating tensions that need to be managed effectively to maintain the integrity of the pilot.
- **Lack of Accountability:** Holding SLE stakeholders accountable for their commitments can be challenging, especially when there are no clear agreements or monitoring mechanisms in place. Without proper accountability measures, it becomes difficult to ensure that all parties involved fulfil their roles and responsibilities as expected, potentially leading to disruptions in the pilot project.
- **Timeline misalignment:** Stakeholders' availability to implement activities, and schools' calendar could be in conflict with each other.
- **Decrease in stakeholders' interest:** As time goes by the stakeholders' interest, commitment and availability in relation to the implementation of the SLE it gradually fades away.

Communication between various actors and overcoming challenges

To ensure a smooth SLEs implementation, initiators must encourage open dialogue and communication between the various actors. This can be achieved in the following ways:

Holding regular meetings

SLE initiators and stakeholders are encouraged to hold regular meetings to:

- Define goals of the project together
- Discuss resources and any constraints
- Align the timeline and deadlines

Creating and making use of a collaborative space

Additionally, initiators can also consider creating a collaborative space that they can use with stakeholders to share their ideas, communicate, and co-create. The collaborative space could be an online channel or platform such as a

Facebook group or other tools that would enable easy communication between actors. An example of a platform that they can use is the OSOS platform[4].

At the same time, National Coordinators will provide a platform where all 10 SLE initiators from their country can share ideas, doubts and challenges and ask for peer-support of the other projects.

Step 3: Co-creation and Implementation

During the co-creation and implementation phase, it is important that all actors share the same vision and goals while they remain committed to them. Defining a learning path using learning resources

Prior to commencing SLE activities, it is crucial for stakeholders and SLE initiators to reach a consensus on the allocation of necessary learning resources, which will be supplied by the stakeholders. With these resources at their disposal, SLE initiators and stakeholders can collaboratively design a structured learning journey for the participants. This includes thinking more concretely about the different steps of the activity, their objectives, process and expected results. In addition, determining the precise stage at which each resource will be utilized and detailing its purpose within the learning process are also recommended.

Planning and organisation of activities

SLE initiators and stakeholders should collaboratively create a comprehensive plan outlining the content, sequencing, activity locations and durations, scheduled dates, necessary resources and permissions, and other essential details. Moreover, they need to make sure that all the activities planned add up to a total of 30-40 hours including regular but also outside classroom hours. Please note that classroom hours should amount to minimum 10/15 hours of activities. During the pilot phase, other implementation details like the number of students/classes to be involved etc. are left to SLE initiators to decide upon.To facilitate them, initiators can use an Overview template file to describe and organise activities including the description of the activity, responsible stakeholder, the duration and implementation modality.

Below we include a list of key points and indicative questions to consider in advance and think about thoroughly which can be useful in the preparation and successful completion of this step

- Creating a project in partnership is done by following or adopting a process such the living lab co-creation practice. Is this process clear to all participants?
- Are all relevant stakeholders included in the process or is their active participation ensured?
- Is a shared vision co-created that is jointly defining the problem statement, goals, and ambitions of all in the partnership?
- Does it clearly embed all stakeholders' interests?
- Co-creation in practice may require participants to commit to a more open, transparent, and flexible attitude and way of working. Are all aware and committed to this?

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[4] http://portal.opendiscoveryspace.eu/en/osos/

- Is an overall plan of activities co-created?
- For the plan to succeed, are the committed resources adequate or well-foreseen?
- Is it well divided in tasks or iterative phases of exploration, experimentation, and evaluation?
- Are the expected outcomes or results in each task or phase clearly defined? Are they understood by all?
- Are division and allocation of roles, responsibilities and resources clear to all partners?
- Is allocation based on interest, expertise and capability of each partner?
- Are all aware of and do agree on associated commitments, dependencies, contributions, and implications?

Defining learning products/artefacts in relation to curriculum needs

SLE Initiators and their stakeholders need to define the various learning products or artefacts that they expect learners to produce using the learning resources. "Learning product" is any (physical or digital) product created by students themselves during learning activities. Learning products reflect key knowledge, skills and competencies needed for their creation, and can be used for assessment purposes (peer; formative; summative). Examples of learning products are data sets and graphs, posters (text and pictures), designs, physical models and so on.

When defining the learning products, the actors should keep in mind the following:

- What type of learning product will the learners develop?
- How is the learning product connected to the curriculum?
- What skills or knowledge will the learners acquire through the product and resource?
- How long will it take to create the learning product?
- How will we assess the product and resource?

More guidance on what are learning artefacts and how to plan appropriately for them can be found at this link.

Implementation of the activity

Collecting learning products

On the designated date, the SLE Initiator is responsible for gathering and sharing activities' learning products with the predetermined point of contact, involving learners, SLE Initiators, and stakeholders. The collection and sharing will follow a series of rules aiming to protect learners' anonymity and privacy.

Observations and feedback

During the activity, SLE Initiators will record their and the stakeholders' observations of the session and pass them on to the National Coordinators. SLE Initiators can also gather feedback from learners and stakeholders participating in the activity.

National coordinators can provide SLE initiators with a template of Reflection and feedback questions that the Initiators can fill out with the Stakeholders.

A more detailed description of the SLEs step-by-step development process is available in Section 2.2 of the SLEs Methodology First version, with link to the document (project website), which also include guiding questions for the SLEs initiators.

Step 4: Reflection and sharing of results

Collecting Best Practices and incorporating feedback into improvements

National Coordinators will gather the feedback received from SLE Initiators, stakeholders and learners and incorporate them into the policy recommendations and reviewed methodology that will be shared with the European Commission. Key points from the feedback and best practices can be shared with the rest of the consortium.

Below we include a list of key questions to consider in this phase.

- Thinking about the whole project, including its objectives, its participants, their roles and actions, its processes, and its outcomes, what did go well and what not?
- What was the main element or elements behind successful outcomes or what was the main cause of any problems? Was it process related; people, institution and attitudes related; conditions or resources related?
- What can be done differently, and how?
- What are the main lessons learned?
- How the lessons learned can be best shared and with whom?
- How achieved outcomes or proposed solutions can be sustained or replicated at wider scale

Dissemination and communication

Initiators can promote the pilot efforts on various social media platforms and local media by writing blog posts or short articles, posting pictures and learning product results, prior collecting participant consent.

Celebrating Achievements and Recognitions

National Coordinators are encouraged to keep track of outstanding SLE Pilot activities, highlight them on their social media and provide certificates to SLE Initiators and stakeholders.

In accordance with the specific requirements of each country, SLE Initiators have the option to establish a collaborative agreement with the stakeholders engaged in their respective SLE. While this agreement is not legally binding, it serves as a formal affirmation of the stakeholders' commitment to the SLE and can offer them added incentive to effectively fulfil their responsibilities. Digital recognition badges will be awarded to stakeholders with excelling contribution in the pilot phase.

Data Collection and Evaluation

Data Collection Focus & Procedures

During the implementation of the SLEs project, SLE Initiators will be collecting different kinds of data at various stages. National Coordinators can guide them to ensure they only collect the required data and not sensitive data. SLE Initiators will collect both personal data and non-personal data such as the learning products.

Personal data collection

Personal data refers to the following kinds of data:

- First name and last name
- Email address
- Birth date
- Address
- Photos / audio / video
- Phone number
- Gender

The following are examples of instances where SLE Initiators might collect personal data:

- Names, email addresses and phone numbers of experts they might invite to a classroom
- Photos / audio / video of experts or stakeholders
- Names, email addresses of participants in a meeting
- Screenshots of an online meeting
- Posting names and photos of experts or teachers on social media
- It is mandatory that SLE Initiators receive consent from participants before collecting and recording personal data. National Coordinators are required to provide this consent form to SLE Initiators to use.

SLE Initiators must also get written consent before capturing photographs/recording audio or video of experts and sharing with National Coordinators.

Collecting personal data of students

It is important to note that during the SLEs pilot and mature phase, the Consortium **does not collect** any personal data of students due to GDPR requirements. This policy extends to teachers who work with students during the pilot phase. Teachers must avoid collecting personal data such as full name, email address, address, gender, birth date and phone number of students for the purpose of sharing with National Coordinators.

Personal data also includes photos / audio / video recordings. Teachers must not capture any photos or record audio/videos of students without explicit consent from their parents beforehand.

Teachers can capture only photos that do not show the faces of students or reveal identity.

Collecting Learning products

When students create learning products/outputs such as drawings, reports and so on, teachers must anonymize all personal data contained in these products before sharing them with the national coordinator. More information on how to plan and collect Learning Artifacts can be found here.

Evaluation

National Coordinators are responsible for collecting learning products/outputs from the SLE Initiators for evaluation.

A complete list of the questionnaires, artefacts and other material than each SLE will need to provide to the National coordinators can be found at Table 2 below

TABLE 2 OUTPUTS FOR THE EVALUATION PHASE

Output
Portfolio
Project Evaluation Survey - you could either do it during a final meeting where each stakeholder contributes to the questions with their views, or have a shared document and ask stakeholders to fill it
Interview - Please note that the responses to the open questions in the Project Evaluation Survey can be used to complete the Interview template (especially questions 4 to 8).
Uploading learning artefacts
Creating a learning scenario based on all the previous templates.
(Facultative) Collect students' & parents' quotes on their project experience
(Facultative) Consider asking learners to create a video, at the end of the project, to reflect on the project activities, the learning products they produced, and what they feel they have learned.
(Facultative) Develop a toolkit for SLE support that has been useful for your SLE based on experiences gained

Guidelines on appropriate usage of AI

Generative AI usage (such as Gemini, ChatGPT, Co-pilot etc.) can support initiators in the implementation of their projects, and we therefore support exploring its functionalities. However, the pilot phase experience has also highlighted the risks of allowing unconditioned usage of these tools, as we noticed that submitted templates presented unreliable or false information, and certain project proposals lacked originality and creativity due to being written entirely through generative AI tools.

AI systems must be used responsibly and ethically, avoiding any actions that could harm others, reflect bias or unfairness against certain groups of people, create harmful content, violate privacy, or facilitate malicious activities (e.g., generate fake news or to spread misinformation.)

Users are responsible for any AI-generated content on which they rely or which they share with others, as if it were their own work, and must carefully review content for accuracy and make necessary adjustments before acting upon it. Users should be prepared to explain and justify the outcomes generated by AI systems on which they rely or which they share with others.

For these reasons, we encourage initiators to promote a responsible, supervised use of AI, and which serves to support, rather than substitute, human creativity, production of written output, or analysis of results. Therefore, it is accepted to write a text and ask AI to review it for grammatical coherence, but we advise against having it produce the whole text and submitting it without any revision of its content. Likewise, AI can provide interesting insights and additional inputs to improve your project initial idea, but having it come up with the whole concept may result in an unoriginal project that is detached from the real needs of students.

Additionally, we strongly advise against, and take no personal responsibility for the following use of AI tools within the project:

- the use of online AI tools (such as ChatGPT) to analyse, access, modify or otherwise process existing content, images or software code that is not exclusively created by you and for which you don't have the permission of the authors. Whether for external or internal messaging, or other uses, this content is subject to copyright laws.
- the use of online AI tools (such as ChatGPT) to analyse, access, modify or otherwise process information that contains personal data, or otherwise sensitive or confidential information (such as financial information).

Failure to comply will result in the exclusion of the project's outputs from all communication and dissemination activities, included the repository of learning artefacts.

For more guidance on the use of AI for the production of research outputs, please refer to the Living Guidelines on the Responsible Use of Generative AI in Research, by the European Commission[6]

Mentoring

Facilitation of SLEs

During the SLEs implementation cycles, we will offer a comprehensive **facilitation programme** encompassing different modalities, online or in-person, that include hands-on facilitation workshops, guidelines, and access to resources. The aim of the SLEs facilitation programme is to help SLEs initiators to explore, adopt, implement, and improve their SLEs in collaboration with their stakeholders.

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[6] Available at: https://research-and-innovation.ec.europa.eu/document/download/2b6cf7e5-36ac-41cb-aab5-0d32050143dc_en?filename=ec_rtd_ai-guidelines.pdf

This program will offer transnational activities, for all SLEs, irrespective of their country. At the same time, the National Coordinators will be encouraged to replicate these activities to national level by using the methodology and material developed.

The SLEs facilitation programme is built around the following general **educational objectives**:

- To enable teachers and other stakeholders involved in a SLE to try new ideas in practice to improve and increase knowledge about the curriculum, teaching, and learning opportunities within a SLE.
- To raise their level of critical thinking about teaching and learning, and in general about their everyday practice.
- To engage them in collaborative and reflective implementation and development of SLEs.
- To facilitate the adoption of the SLE concept and approach in teaching and learning.
- To emphasize the importance of sharing experience, expertise and valuable outcomes with other teachers and stakeholders in their community and beyond.
- To empower them in engaging in similar approaches to SLE that affect their communities and well-being and for their particular needs or interests.
- To strengthen their capacity to become educational content creators or opportunity explorers to overcome standard curriculum constraints.

Key aspects of the SLEs facilitation programme:

- Overall inclusive approach
- Multidisciplinary/interdisciplinary collaborative approach
- Modular structure that allows NCs to use/replicate only what matches to their respective national needs.
- Replication potential
- Low-threshold use of ICT technologies
- Open and online modes complementary to in-person workshops
- Scientific and technological correctness
- Emphasis on experiential aspect, practical hands-on training, and do-it-yourself implementation
- Building learning-industry synergies
- Foster STE(A)M Careers guidance with a focus on gender stereotypes

The SLEs facilitation approach includes the organization of several **facilitation workshops** for SLEs initiators and stakeholders during both the pilot and mature SLEs cycles of implementation. Detailed guidelines for both pilot and mature cycle workshops are included in Section 2.4 "Facilitation methodology and guidelines" of the SLEs Methodology second version.

In each implemented SLE, the stakeholders, with support from the National Coordinator, will implement the methodology provisions for facilitation and mentoring and for learner meaningful engagement in ways relevant to the local context.

In this section we explore key aspects and areas of mentoring, and we provide an initial list of mentoring resources that could be used by SLEs initiators and stakeholders during the implementation phase. It is important here to mention that the local contexts, and participants' individual characteristics and needs must always be taken in consideration to implement an effective mentoring activity. The SLEs coordinators, initiators and participating stakeholders are encouraged to experiment with what works best for their context and to share reflections on their experience toward an effective and innovative mentoring methodology.

Here below we highlight some key aspects of mentoring:

- Selecting **appropriate mentoring strategies** and activities according to individual needs, as well as identifying and accommodating different communication styles with the mentee.
- **Establishing a relationship based on trust.** Building trust and a sense of belonging through ongoing discussions between the mentor and the mentee are essential to help understand the needs, create boundaries, manage expectations, and commonly agree on the goals and activities to reach them. A trusting relationship is an essential pre-condition to conduct mentoring activities effectively. It can be beneficial to start the mentoring activities at the beginning of the SLE implementation process.
- Providing **clear information and accessible resources** related to the mentoring area is another important aspect of the relationship between the mentor and the mentee. The information may be given to a group of learners inside or outside the classroom, provided in paper or shared online together with resources via an online common space accessible by all.
- Providing **constructive and supportive yet challenging feedback**, balancing protection, and criticism.

Potential areas of mentoring within and across SLEs partnerships:

- Leadership
- Professional development
- STEM careers
- Collaboration and communication (including co-design, etc.)
- Data analysis and monitoring
- Pedagogical practices
- Curriculum development and assessment (e.g., understanding STE(A)M)
- Digital-technological (e.g., use of open/flexible environments, digital tools, technology, etc.)
- Policy/advocacy

Useful resources:

- The difference between mentoring and coaching is described in the "Mentoring and Coaching CPD Capacity Building Project: National Framework for Mentoring and Coaching" [7] short practical guide produced by the Centre for the Use of Research and Evidence in Education (CUREE) in 2005. While both mentoring and coaching are structured, sustained processes, mentoring "supports professional learners through significant career transitions" and coaching "enables the development of a specific aspect of a professional learner's practice".
- A reflective guide to mentoring and being a teacher-mentor (Victoria State Government, Australia, 2016)[8].
- Mentor self-evaluation form for self-reflection (University of Wisconsin-Madison, USA)[9], to identify areas in which you feel less confident as a mentor.

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[7] http://www.curee.co.uk/files/publication/1219925968/National-framework-for-mentoring-and-coaching.pdf.
[8] Reflectiveguidetomentoringschools.pdf (education.vic.gov.au)
[9] Online Survey | Built with Qualtrics Experience Management™

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- Teachers mentor toolset (Oregon Department of Education)[10], including a set of useful tools providing best practices, resources, and tips to help you with your goals for mentoring and to establish collaborative relationships with your mentees.
- How to provide constructive feedback (European Schoolnet Academy, 2022)[11].
- The 3 best ways to build trust for mentors, Art of Mentoring (Richardson, 2019)[12].
- A Foundational Guide or Mentoring Students (A.D. Tomlin, Interfolio, 2021)[13].
- Online mentoring for girls in secondary education to increase participation rates of women in STEM: A log-term follow-up study on later university major and career choices (H. Stoeger, T. Debatin, M. Heilemann, S. Schirner, A. Ziegler, Annals of the New York Academy of Sciences, 2023)[14].

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[10] Oregon Department of Education: Teacher Mentor Tools : Mentoring : State of Oregon

[11] Constructive_Feedback_EUNA.pdf (europeanschoolnetacademy.eu)

[12] The 3 Best Ways to Build Trust for Mentors - ART OF MENTORING

[13] Blog - A Foundational Guide for Mentoring Students - Interfolio

[14] (PDF) Online mentoring for girls in secondary education to increase participation rates of women in STEM: A long-term follow-up study on later university major and career choices (researchgate.net)

Annex 1: email draft to reach out to stakeholders.

Dear XXX,

I hope this message finds you well. We write to you to introduce and invite you to the STE(A)M Learning Ecologies (SLEs) project, which is funded through the EU's Horizon Europe program.

The SLEs project's goal is to develop "learning ecologies." These are participatory infrastructures in which the formal and informal systems of education (schools, universities, various organizations, businesses) join forces to enhance STE(A)M education. The project's objective is to enhance students' creativity, critical thinking, and ability to solve problems relevant to real life through cross-sectoral education.

Such expertise and perspective might prove useful to this initiative. We are, however, ready to exchange some of our ideas with you and perhaps even discuss ways in which we can all collaborate in the various activities to achieve our common objectives and improve our societies in one way or another.

If this is of interested to you, we would be happy to provide more information and discuss ways how we can collaborate. Please, let us know when it is most convenient for you to meet.

We are grateful for your consideration of this opportunity and looking forward to your feedback.

Best regards,

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