

● EVALUATION FRAMEWORK

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Executive summary

The 'Schools as Living Labs' (SALL) project is a Coordination and Support Action (CSA) funded under the Science with and for Society (SwafS) objective of Horizon 2020 (H2020), the Research and Innovation Programme of the European Union. In particular, SALL is a project serving Europe's aim to promote open schooling and collaboration on science education. Moving in this direction, SALL proposes the living lab methodology as a technique for the development of open schooling activities linked to science learning in Europe's schools. Further, SALL chooses to demonstrate the use of this technique through activities prioritizing a focus on the theme of the food system and its links to the Food 2030 research and innovation policy of the European Union.

The SALL team, including ten consortium members and three linked third parties, consists of institutions from twelve countries (Belgium, Croatia, Cyprus, Estonia, France, Greece, Israel, Luxembourg, the Netherlands, Portugal, Serbia, Spain) representing diverse worlds: schools, universities and research organisations, science museums and centres, NGOs, business. Dialogue and mutual learning among these worlds lies in the heart of SALL.

The objective of WP5 'Evaluation' in SALL is to assess the impact of the proposed SALL methodology on individuals and organisations involved, as well as more widely on their social context. Also, the evaluation of the project focuses on studying the transferability and adaptation mechanisms that may facilitate and support the effective application of the living lab approach in other relevant contexts of science learning. Thus, the formative assessment of the project will concern the collection of feedback in the course of the development and implementation of the SALL methodology for open schooling, to improve the methodology and its implementation in schools. The impact assessment will establish the extent to which, and ways in which, the proposed living labs methodology for the development of open-schooling inspired partnerships between schools, local communities, civil society organisations, universities and industry:

- In the short term: contributes to a more scientifically interested and literate society and students with a better awareness of and interest in scientific careers
- In the medium term: provides citizens and future researchers with the tools and skills to make informed decisions and choices
- In the long-term: contributes towards the European Research Area (ERA) objectives of increasing the numbers of scientists and researchers in Europe.

The present document constitutes deliverable D5.1 'Evaluation Framework', which focuses on presenting and describing a conceptual and methodological framework for the evaluation of the project's activities. A modular evaluation toolkit was prepared, for the in-depth study element for the 42 focus schools (year 1) and also a lighter core element of evaluation tools to be used by all 412 participating school communities (year 2 and 3). Given that the SALL methodology will be refined after year 1, the

tools and protocols of conduct for year 2 and 3 will be further developed and enhanced in order to match the revised methodology and also the wider context of the study.

1. Introduction

The objective of WP5 'Evaluation' in SALL is to assess the impact of the proposed SALL methodology on individuals and organisations involved, as well as more widely on their social context. Also, the evaluation of the project focuses on studying the transferability and adaptation mechanisms that may facilitate and support the effective application of the living lab approach in other relevant contexts of science learning. Thus, the formative assessment of the project will concern the collection of feedback in the course of the development and implementation of the SALL methodology for open schooling, to improve the methodology and its implementation in schools. The impact assessment will establish the extent to which, and ways in which, the proposed living labs methodology for the development of open-schooling inspired partnerships between schools, local communities, civil society organisations, universities and industry:

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The deliverable D5.1 'Evaluation Framework' focuses on presenting and describing a conceptual and methodological framework for the evaluation of the project's activities. A modular evaluation toolkit was prepared, for the in-depth study element for the 42 focus schools (year 1) and also a lighter core element of evaluation tools to be used by all 412 participating school communities (year 2 and 3). The goal of the in-depth study is to suggest improvements in the SALL methodology and also to refine the lighter evaluation process for years 2 & 3 of the project, based on the findings and participants' and partners' suggestions. Given that the SALL methodology will be refined after year 1, the tools and protocols of conduct for year 2 and 3 will be further developed and enhanced in order to match the revised methodology and also the wider context of the study.

It is noted that all the evaluation procedures were developed and will be implemented in accordance with the ethics and data policies of the project, as presented in the Ethics Handbook (D7.4) of the SALL project.

This deliverable is divided into two sections. In the first section the process for developing the Evaluation Framework is described. The second section focuses on presenting the Evaluation Framework of the project including the timeline of the evaluation process for year 1 to 3 and the presentation and description of the evaluation tools and procedures.

2. Developing the Framework

The Evaluation Framework was developed in four phases as described below. The goal of this Deliverable is to present and describe a conceptual and methodological framework for the evaluation of the project's activities. During its development, the need for flexible, practically applicable evaluation methods and tools was taken into consideration.

2.1. Phase 1: Identification of the different participatory levels of the project

Based on the experience of the consortium in other similar projects (e.g. OSOS project) four participatory levels were identified for which the evaluation will be focused on:

- Students (upper primary school, middle school and high school)
- Teachers (mainly STEM disciplines)
- School (administration staff, e.g. principal)
- Societal actors (all individuals or institutions that have a common interface and/or a common interest with the school, and that are interested or affected by the process or the outcomes of the project; e.g. NGOs, city hall, parents, industries, local business organizations, etc)

The definition of the participatory levels, the expected impact per participatory level and some initial ideas regarding the development of the Evaluation Framework were deliberated through online meetings and discussions with the consortium and mainly the partners responsible for developing the Living lab methodology in order to create clear connections between the suggested methodology and evaluation of the project. A representative extract from an initial mutual brainstorming with partners from WP2, WP3, and WP5 that took place during an online meeting is provided in Figure 1.

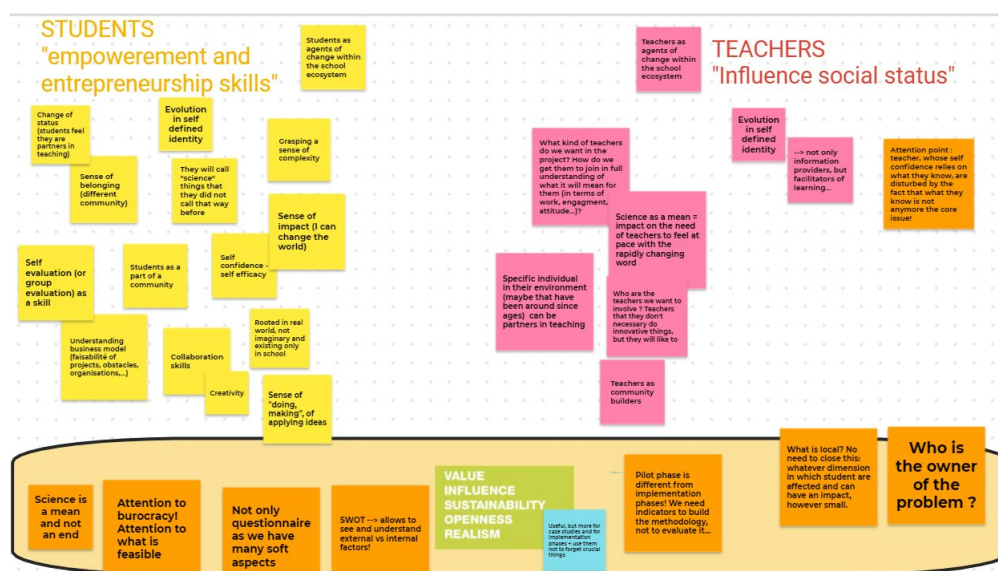


Figure 1: A screenshot of a part of the initial brainstorming (using the Jamboard online tool) during a meeting with the WP2, WP3 and WP5 leaders regarding the different participatory levels of the project, the expected impact per participatory level and some initial ideas regarding the development of the Living lab methodology and the Evaluation framework.

These participatory levels were formed by taking into consideration the age, participation role and expected impact of the project on each participatory level, peculiarities of educational systems of the participating countries, as well as issues regarding ethics and data policies (e.g. collecting data from minors).

2.2. Phase 2: Review of current scientific practices and experience of partners in similar projects

After identifying the different participatory levels of the SALL project, an initial exploratory search for similar living lab projects was conducted in order to identify existing scientific practices that relate to evaluation. This initial search revealed six types of projects/studies/articles concerning the Living lab construct that are as follows:

1. Presentation of cases of various living lab projects.
2. Living labs implemented in urban or rural areas for promoting social change or innovation.
3. Living labs implemented by industries for the creation of innovative products.
4. Living labs as a teaching approach mainly in Universities' courses or as an innovation incubator for the Universities.
5. Living labs as an approach for teacher's training or as a teaching approach in schools.
6. Living labs as a methodology of how to implement this approach in a wider or in a specific context.

The majority of these projects/studies/articles did not provide adequate information with regard to evaluation or did not implement any evaluation processes for demonstrate the impact of their project. Thus, in the second targeted search (on Google and Scopus) with the keywords "living lab project" OR "living lab" AND "education" the following criteria were used for selecting projects and/or articles for further analysis: 1. following a living lab methodology, 2. providing some information about their evaluation process and 3. engaging students as the main implementors or active participants. In addition, partners of the SALL consortium who had prior experience with relevant projects also suggested projects that met these criteria. The findings of this targeted search revealed eight projects/articles that were chosen for further analysis and are presented in detail in Appendix I.

As it is evident from the Table in Appendix I, five out of eight Living lab projects carried out multiple implementations, while the rest carried out one. Most of these implementations were carried out in European Countries. Three projects ("DESCI", "Living Schools Lab", "Analysing Co-Creation in Educational Living Labs using the Knowledge Appropriation Model") concerned school settings (primarily secondary schools), three projects concerned implementations in the context of universities' living labs ("Towards a Living Lab to support evidence-based educational research and innovation", "Student living labs as innovation arenas for sustainable tourism", "Living Labs in Architecture as Innovation Arenas within Higher Education Institutions"), one living lab project concerned the wider community

("SmartIES") and one was an industry-related living lab ("CIRC4LIFE"). All the projects involved more than one participatory level, mainly schools, research organisations, students and industries.

Common trends in relation to the evaluation procedures that were followed in the context of the aforementioned projects were identified. Several projects were implemented in iterative cycles since they followed an iterative living lab methodology approach. In each cycle, the evaluation process that was followed was considered either as an integral part of the living lab approach (e.g., assessment of the impact of the living lab methodology on students) or as part of the overall assessment of the project's impact (e.g., assessment of the enhancement of skills). The focus of evaluation in the context of these projects was mainly on assessing participants for a variety of aspects directly and/or assessing the methodology/process of the implementations, which was of course based on the overall rationale of the projects. For example, the DESCI project's aim was to promote alternating training in secondary school systems based on the Living lab approach by adopting participatory design methodologies. In this project, the prior experiences and the expectations of all alternating training actors and the improvement of students' competences/ skills were evaluated. In the "Living Schools Lab" project the incentives for participating schools/teachers were evaluated. In addition, the exploitation plans of the project's Living Schools Labs network were evaluated and possible obstacles for the growth of the network were identified. In the "Towards a Living Lab to support evidence-based educational research and innovation" project, it is mentioned that the research and innovation process that occurred in the Living Lab was assessed. In the Methodology Handbook of the SmartIES project, it is suggested that the value of Living Lab operations can be assessed with five Living Lab Key Principles: Value, Influence, Sustainability, Openness and Realism.

As far as the data collection tools used in the context of these projects is concerned, the use of questionnaires was a frequent choice by different projects but the emphasis on collecting a variety of qualitative data (through observations, interviews, focus groups, analysis of documents, etc.) was highlighted in almost all projects. For instance, in the "Living Labs in Architecture as Innovation Arenas within Higher Education Institutions" paper, a mixed-method approach to evaluation is described. Another common process that was evident in the implementation of these projects concerned the development of case study reports in order to describe in detail the different living labs, to disseminate their actions and/or to measure their impact on the participants. For example, in the "Analyzing Co-Creation in Educational Living Labs using the Knowledge Appropriation Model" paper, several case studies of Educational Living Labs which introduced innovative teaching practices in STEM subjects in secondary schools were described. Given the complexity of the Living Lab construct (e.g. variety of participants, different roles and types of engagement in these projects, collaboration at different levels), these types of tools provide the opportunity to gather rich information about the processes followed during the design and implementation of such project, and also to gain insight into the interrelations that take place among the different participants.

Overall, based on the review of Living lab projects, it became apparent that iterative cycles of evaluation with the use of multiple tools can portray not only the effect on each participatory level but also the interplay between these levels, which are considered essential especially for the in-depth study of year 1. The remaining two phases of the framework's development were based on this rationale.

2.3. Phase 3: Adaptation or development of evaluation tools for each participatory level and year of project's implementation

A variety of tools and evaluation procedures were identified during the review of Living labs projects but also through partners' expertise in evaluation procedures in similar projects. After identifying possible tools per participatory level, discussions with the partners followed in order to make adaptations on the tools and evaluation procedures based on the proposed SALL methodology. A draft evaluation timeline and protocol of conduct was also discussed with national coordinators in order to consider each country's context and educational system.

Two rounds of feedback were applied during this process for refining the suggested tools and making additional suggestions to the first version of the proposed Evaluation Framework. For example, partners suggested in the first round of discussions to introduce the SWOT analysis as a reflection process for teachers to facilitate the planning of their school's project. In the second round of discussions the process was further enhanced after suggestions of the partners for collecting data for the SWOT analysis not only by one-to-one interviews, but also by using other means of communication (e.g., organizing a focus group during a workshop) to discuss related issues with a variety of participants to spontaneously facilitate the data collection process and also support the co-designing of the school project.

2.4. Development of a modular evaluation toolkit

Based on the literature review and partners' expertise, the SALL evaluation toolkit was developed. Based on the discussions and work done during the previous phases, three basic principles guided the development of the final Evaluation Framework:

- Flexibility (e.g. applicability in different educational contexts and levels, multiple ways of collecting data)
- Practicality (e.g. reasonable timeframe for collecting and analyzing data, detailed description of the processes to be followed)
- Explicit connections to the SALL methodology and opportunities to integrate the evaluation procedures within this methodology (e.g. use of the SWOT analysis not only as an evaluation tool but also as a planning tool for schools' projects designs and implementations)

This modular toolkit is presented in the next section of this Deliverable and includes all the necessary information and tools that will be used for the evaluation of the SALL project: timeline of evaluation procedures and description of the evaluation tools and the relevant protocols of conduct.

2. The Evaluation Framework of the SALL project

2.1. Evaluation Timeline

A timeline was developed for the three years of implementations of the SALL project (see table below). Overall, 412 school communities will be engaged in the project, including both primary and secondary schools. The project activities will involve at least 1,000 teachers, and at least 10,000 students and their families. Of these, 42 schools will form the focus community of SALL schools in year 1 (Cyprus, Greece, France, Israel, the Netherlands, Portugal, Spain and the two Eastern European / Balkan countries that will be recruited through ECSITE's linked Third Parties), in which the project will carry out the study of living-lab-based open schooling in greater depth through more intensive co-design, implementation and evaluation activities. In year 2 and 3, the project will carry out larger-scale implementations involving not only the focus community of the 42 schools involved in year 1, but also the wider community of additional 370 schools, reaching overall a number of 412 school communities in 9 countries.

As presented in the table below, a pre-post design will be followed for administrating the tools in order to be able to identify changes in the four participatory levels as a result of the implementation of the SALL methodology. During the schools' implementations, the partners will provide support to the participants and collect data and feedback when needed.

The first year of implementations of the SALL project is considered to be a pilot phase in order to refine the suggested Living Lab methodology and also to create a lighter evaluation process for year 2 and 3 during which a wider community will be formed. Based on the interim evaluation report (i.e. findings from the pilot implementation activities in year 1) and the feedback of partners, the tools for year 2 and 3 (wider community implementations) will be further developed and adapted and the suggested procedures will be refined. The evaluation tools and the relevant protocols of conduct presented in the table, are described next.

	YEAR 1 FOCUS COMMUNITY			YEAR 2 WIDER COMMUNITY		YEAR 3 WIDER COMMUNITY	
Participation level	Pre-Year 1	Post-Year 1		Pre-Year 2	Post-Year 2	Pre-Year 3	Post-Year 3
Students	Questionnaires	Questionnaires	Case studies	Questionnaire	Questionnaire	Questionnaire	Questionnaire
Teachers	Expectancies SWOT	Impact SWOT		Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach
Schools				Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach
Societal Actors				Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach	Beliefs questionnaire towards SALL approach

Table 1: SALL Evaluation Framework; Evaluation tools per evaluation level for each implementation year of the SALL project

2.2. Evaluation Tools and Procedures

2.2.1. Students' Questionnaires

For the in-depth study (year 1) two questionnaires were developed for the students' participation level: The Science Attitudes Questionnaire (see Appendix II) and the Civic Engagement Questionnaire (see Appendix III). Each tool purpose and format are described below:

Science Attitudes Questionnaire. The Science Attitudes Questionnaire consists of 30 items rated on a five-point Likert scale ranging from 1 (=strongly disagree) to 5 (=strongly agree). Six dimensions of science attitudes are evaluated through this questionnaire which are as follows:

1. *Intrinsic motivation*: refers to the inherent satisfaction in learning science for its own sake;
2. *Career motivation*: pertains to learning science as a means to a tangible end, such as a career;
3. *Self-determination*: refers to the control students believe they have over their learning of science;
4. *Self-efficacy*: refers to students' belief that they can achieve well in science;
5. *Attitudes towards practical work in science*: refers to students' feelings about the practical aspect when doing science;
6. *Attitudes towards science outside school*: refers to students' feelings about any science related activities performed beyond the school boundaries;

All six dimensions derived after a thorough review of related literature that concerns students' attitudes about science teaching and learning. The specific items of the questionnaire which correspond to each dimension are presented in the table below:

Dimension	Items	Adapted from:
Intrinsic motivation	1, 2, 9, 14, 21	Glynn et al. (2011); McAuley et al. (1987); Plant & Ryan (1985)
Career motivation	5, 7, 10, 19, 20	Glynn et al. (2011); Lent et al., 2008; Kier et al. (2013)
Self-determination	3, 13, 18, 27, 29	Glynn et al. (2011); McAuley et al. (1987); Plant & Ryan (1985)
Self-efficacy	6, 12, 17, 23	Glynn et al. (2011); Lent et al., 2008
Attitudes towards practical work in science	4, 8, 26, 28, 30	Kind et al. (2007)

Table 2: The six dimensions of science attitudes measured in the questionnaire and the corresponding items

Civic Engagement Questionnaire. “Civic engagement describes how an active citizen participates in the life of a community in order to improve conditions for others or to help shape the community’s future” (Adler & Goggin, 2005, pg. 241). This type of engagement is highly encouraged among young people through a variety of actions which concern real-life issues of their local community and society in general. Civic engagement could be promoted through education, firstly by developing students’ critical thinking and skills to make educated decisions about civic issues and by promoting fundamental values of society (Dee, 2004).

In the context of the SALL project and more specifically through the promotion of open schooling, students are expected to become agents of community well-being by creating new partnerships in their local communities. Thus, the Civic Engagement Questionnaire was developed based on adaptations from Furco, Muller, and Ammon (1998) Civic Responsibility survey (Level 2-Middle School, and Level 3-High School) to evaluate the enhancement of students’ civic engagement through their active involvement in the SALL project. An initial version of the questionnaire consisting of 18 items based on selection and adaptations from the Furco, Muller, and Ammon (1998) was developed and shared with partners of the consortium for internal review. Based on partners’ comments and suggestions which concerned adaptations in terms of the terminology used in specific items, as well as removing some items that related to aspects that were not associated with the objectives of the SALL project, a revised version of the questionnaire was developed and again was shared for internal final review. The final version of the Civic Engagement Questionnaire consists of 12 items rated on a five-point Likert scale ranging from 1 (=strongly disagree) to 5 (=strongly agree) (see Appendix III).

Protocol of conduct. The questionnaires will be administered before and after the schools’ implementations in paper-and-pencil format or in digital form (e.g. with the use of digital tools like Google forms or SurveyMonkey). The format of the questionnaires and the way they will be administered can be chosen by the national coordinator and/or the teacher(s). It takes approximately 20 minutes for students to fill in both questionnaires but they can also be provided as homework. National coordinators will provide the raw data (i.e. students’ answers to each item of the questionnaires) in an Excel file after collecting them (pre and post). Parametric and/or non-parametric tests (depending on the sample size) with the use of the IBM SPSS Statistics software will be used for analyzing the data and identifying the project’s impact on students’ attitudes and civic engagement.

Students’ questionnaire for year 2 and 3. For the lighter core element study of year 2 and 3 which concerns the wider community of the project, one questionnaire will be created which will integrate the main dimensions of impact of the Living Lab methodology of the project for the students’ participatory level. These dimensions will be identified based on the findings of year 1 (i.e. analysis of the questionnaires), the participants and partners’ feedback (mainly through the case studies reports) and also the overall refinements of the SALL methodology. Hence, this questionnaire will be presented in Deliverable 5.2: Interim Evaluation Report.

2.2.2. SWOT Analysis

What is a SWOT analysis? SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis is increasingly recognised as a firm foundation for resource and competency-based planning and it can be the driving force for implementing change. A SWOT analysis is used to assist organisations in initiating meaningful change in a program and to use the data for future improvement. Thus, the objectives of SWOT are to identify the *strengths, weaknesses, opportunities* and *threats* of organisations or companies in terms of their skills, resources, and strategic planning. Glaister and Falshaw (1999) agree that SWOT analysis is one of the most respected and prevailing instruments of strategic planning. The outcomes are utilized in the strategy construction and evaluation process (Ghazinoory et al., 2011).

SWOT analysis has its origins in the 1960s (Learned et al., 1969) and concerns an approach that has been widely used for businesses, but it is equally useful in the work of community health and development, education, and even personal growth (German, 2013). It allows the researcher to examine organisational performance through two internal domains—strengths and weaknesses—and two external domains—opportunities and threats. The first two domains have an internal orientation that include attributes of the organisation (e.g., faculty and staff, learning environment, current students, operating budget, various committees, and research programs), while the latter two domains have an external focus (e.g., prospective employers, parents and families of students, competing colleges, preparatory high schools, population demographics, and funding agencies), which examine attributes of the environment (Balamuralikrishna & Dugger, 1995). When applying this analysis, the focus should not only be in identifying these external and internal domains but also to minimize both weaknesses and threats, transform weaknesses to strengths and threats to opportunities and also combine the strengths and opportunities to optimize the potential of an organisation (Danca, 2005).

According to Orr (2013), SWOT analysis components are described as:

- **Strengths:** The strengths refer to the things the organisation or program can do well. Strengths may be the school curriculum, leadership, the overall school environment, faculty, and/or reputation. Questions may relate to the following: *What do you do better than anyone else? What unique resources are accessible to you?* and *Which successful factors can you identify in your workplace?*
- **Weaknesses:** Weaknesses refer to the things the organisation needs to improve. Weaknesses in resources or capabilities prevent the organisation from accomplishing a desired goal or mission. By understanding their weaknesses, they can focus on specific areas that need to be developed and/or improved. In order to address the organisation's weaknesses, the following questions may be raised: *What could you improve? What should you avoid?* and *What type of capabilities (e.g., knowledge, skills, benefits etc.) do you lack?*
- **Opportunities:** Opportunities are trends that could be utilized by an organisation. These are external factors or situations that exist that may have a positive effect on a

company/organisation in achieving a desired goal or mission. Analysing the patterns is beneficial in identifying opportunities.

- **Threats:** *What obstacles do you face in your organisation/company? At this section, the organisation or individual looks at what others are doing. What are they doing better? Threats* are existing as external factors that have a detrimental impact on the effective function of the mechanisms and procedures followed within the organisation/company.

Applying the SWOT Analysis. SWOT analysis is frequently used in organisations/companies as a diagnostic method to identify key factors influencing the success or failure of an organisation's goal or project (Lozano & Vallés, 2007). The results of the SWOT analysis provide important information concerning the trajectory of the organisation which are categorised in 'strengths' that should be promoted, 'opportunities' that have to be pursued, 'weaknesses' to be addressed, and 'threats' that ought to be alleviated by the key people of the organisation (Hovardas, 2015). This might take the form of role playing, round table discussions, interviews, and surveys to gather data, validate findings, and complete the SWOT template to explore the potential of reaching consensus among societal groups.

Hovardas (2015) undertook a pilot study in Greece, by implementing SWOT analysis in order to promote bear conservation in rural communities. A group of pre-service primary teachers overlooked the pilot phase by conducting and transcribing interviews to determine 'strengths', 'weaknesses', 'opportunities' and 'threats' for all societal actors involved in bear conservation. Following the interviews, a SWOT analysis template was prepared and a focus group discussion was arranged to verify the findings of the interviews. From this discussion many important information, interesting findings, and tension points were revealed regarding the 'strengths', 'weaknesses', 'opportunities' and 'threats' of their common objective in an attempt to achieve consensus among stakeholders in bear conservation. The findings of this study suggest that the template of SWOT analysis is considered a valuable tool for assisting organisations in initiating meaningful change in a program by building on 'strengths', eliminating 'weaknesses', exploiting 'opportunities', and mitigating the effect of 'threats' in order to reach potential sustainable solutions.

SWOT Analysis in Business and Education. SWOT analysis is an established method for assisting the formulation of strategy which can be pursued by business managers, marketing researchers, strategy students, consultants, trainers and educators (Helms and Nixon, 2010). Numerous studies have set goals based on SWOT analysis results. To name but a few, the promotion and advertising of olive oil in the Greek market was examined by Blery and Sfetsiou (2008), using SWOT analysis. SWOT analysis was also used by Ahmed et al. (2006) to research Air China and their recent complete implementation of quality control. Tam et al. (2005) studied the fabric and clothing industry in Hong Kong, in order to develop an original brand management company, using SWOT analysis.

Furthermore, SWOT analysis was implemented in an educational setting in a recent study by Resnawati et al. (2020). The researchers aimed at describing and evaluating teacher's professional competence in South Sumatra using SWOT analysis. Their results have informed their future strategy plans in increasing

teacher competence. In another education-focused study, German et al. (2020) aimed to evaluate the syllabus and the learning process for elementary education in Indonesia and to develop the syllabus based on the results of the investigation. Using SWOT analysis, the study reported positive feedback from the participatory school in improving the quality of learning. Moreover, Dyson (2004) studied the strategic development process at the University of Warwick (UK) by linking SWOT analysis to resource-based planning in an iterative process, embedded within overall strategic planning. Overall, the above studies provide evidence that SWOT analysis can be used successfully as an evaluation tool for strategy formulation and setting goals in business as well as in educational settings.

SWOT Analysis for Methodology Evaluation. SWOT Analysis is also considered a significantly valuable tool when evaluating a methodology. Schuurman and De Marez (2016) explored and compared the (in)compatibility of two research concepts the 'Lead User' concept and the 'Living Lab' concept for user-centered innovation research. Using SWOT analysis, the two concepts were compared and similarities and differences were explored in order to propose guidelines and conceptual ideas to integrate these two approaches. Their SWOT analysis, for conceptual integration of the 'living lab' and 'lead user' methodologies, revealed several unanswered questions, stressing the need for further research in this area. This study illustrates the significance of SWOT analysis when aiming at improving and evaluating methodologies to further stimulate knowledge and innovation.

The Living Lab methodology was also examined by Arabska, Shopova and Dimitrova (2014). Their investigation concerned the opportunities for the use of the Living Lab approach in developing sustainable agriculture and tourism sector in rural areas in Bulgaria. Using SWOT analysis, they identified strengths and weaknesses, opportunities and threats and made assessments of the statements. In addition, a round table discussion with experts in the field of agribusiness and tourism was organised who assessed the opportunities of application of the Living Labs concept in agribusiness and tourism sector in Bulgaria. Finally, a model was developed for the establishment and functioning of such structures involving key actors in the execution of activities.

SWOT analysis in the context of SALL project. In the context of the SALL project, the focus of this tool is to gain knowledge on the Strengths-Weaknesses-Opportunities-Threats for the implementation of the Living Lab methodology. The SWOT analysis will be used before (Expectancies SWOT) and after (Impact SWOT) the implementations during Year 1. The Expectancies SWOT will be completed in order to support participants in the planning of their project and to get an insight on how the SALL methodology was conceived by them before the implementations. Thus, the Expectancies SWOT will enable the on-going improvement of the SALL methodology and suggested materials and the support of schools during the implementations. The Impact SWOT will be performed at the end of the implementations to get an insight of what the impact of the SALL methodology per participatory level (mainly through the Strengths and Weaknesses reported) was, and also the interaction between the different levels (mainly through the Opportunities and Threats reported). This information will provide the opportunity to make targeted adjustments to the methodology and also to develop a lighter version

of evaluation tools (i.e. beliefs questionnaire towards the SALL approach, see Table 1) for years 2 and 3 of the project.

As presented in the three tables below, a semi-structure interview protocol was developed for each participatory level (i.e. teachers, schools, societal actors) for collecting the data for both the Expectancies and Impact SWOT analyses. The questions presented in the protocols, as well as the indicative examples of answers were provided to partners to facilitate their understanding of what information they will need to gather for each dimension of the SWOT. Of course, the option to adjust the questions to the specific context of the interview and/or to add clarifying questions when needed is provided to the partners to make flexible choices. The interviews during the pre-phase of year 1 serve also as a reflection and planning tool for all participatory levels and as a result, they can facilitate the planning and implementation of the school projects as well. The Impact SWOT will follow the same process and interview protocols as the Expectancies SWOT, but refinements might be made, if necessary, after collecting feedback from participants and partners during the pre-phase.

Internal attributes	S	Strengths	<p>What type of capabilities (e.g., knowledge, skills, etc.) that you possess do you consider as essential for the effective application of the living lab methodology in the context of the project you are going to engage with?</p> <p><i>e.g. "I have already participated in the OSOS project and so, I know how to engage relevant societal actors in my project"</i> <i>[previous experience with other projects]</i></p> <p><i>"From previous experience, I know that it is important to contact with societal actors who feel like they want to have a significant contribution to the community, so a careful selection of the societal actors is an essential first step!"</i> <i>[knowledge about what motivates societal actors]</i></p>
	W	Weaknesses	<p>What type of capabilities (e.g., knowledge, skills, etc.) that you lack of do you consider as essential for the effective application of the living lab methodology in the context of the project you are going to engage with?</p> <p><i>e.g. "I have never implemented such an open project with students and I am afraid I will not be able to handle it. I prefer to implement more guided activities". [low self-efficacy to participate in open activities]</i></p> <p><i>"A major struggle for me is to be able to explain to a societal actor, who is not affiliated with education, the rationale behind the project we would like him/her to collaborate with". [lack of communication skills]</i></p>
External attributes (interaction with the environment)	O	Opportunities	<p>What type of opportunities are offered by the school/ societal actors/ students that might facilitate the introduction of living lab methodology in the context of the project you are going to engage with?</p> <p><i>e.g. "the school's administration expressed interest in our project and it is willing to provide some extra time for us to organize our actions" [provision of extra time by the school for organization purposes]</i></p>
	T	Threats	<p>What type of risks might hinder the introduction of living lab methodology in the context of the project you are going to engage with while collaborating with the school/ students/ societal actors?</p> <p><i>e.g. lack of interest in active participation and co-creation in the project. I believe most organizations will participate during the initial stages of the project and then give up if they do not have something to gain [lack of interest for long-term participation unless there is a profit for them]</i></p>

Table 3: SWOT Interview protocol for teachers

Internal attributes	S	Strengths	<p>As a member of school's administration, what type of capabilities (e.g., knowledge, skills, benefits etc.) that you have do you consider as essential for the effective application of the living lab methodology in the context of the project your school will be engaged with?</p> <p><i>e.g. as the principal of the school, I can form a cohesive group of teachers that can effectively collaborate with each other to implement the project <u>[understanding the dynamics between his teaching staff]</u></i></p>
	W	Weaknesses	<p>As a member of school's administration, what type of capabilities (e.g., knowledge, skills, benefits etc.) that you lack of do you consider as essential for the effective application of the living lab methodology in the context of the project your school will be engaged with?</p> <p><i>e.g. We have never had to work with a number of societal actors for a long-term project. Our main collaborations thus far mainly concerned one day presentations by different organizations for a specific concept. So, I am not exactly sure how to attract certain organizations to our project. <u>[lack of knowledge on how to attract relevant societal actors]</u></i></p>
External attributes (interaction with the environment)	O	Opportunities	<p>What type of opportunities which are offered by societal actors might facilitate the introduction of living lab methodology in the context of the project you are going to engage with?</p> <p><i>e.g. we are willing to closely work with the teachers who are collaborating in order to implement their project by re-scheduling the schools' program in order for them to have time to work together <u>[reschedules for facilitating collaboration between teachers of the same school]</u></i></p>
	T	Threats	<p>What type of risks might hinder the introduction of living lab methodology in your school while collaborating with the societal actors?</p> <p><i>e.g. the national curriculum does not allow for much freedom in terms of time and content and so I think this might be an obstacle to certain actions that we want to organize <u>[restrictions of the national curriculum]</u></i></p>

Table 4: SWOT Interview protocol for schools

Internal attributes	S	Strengths	<p>Have you ever thought schools as partners for achieving a certain need/goal? What knowledge/skills that you have do you consider as essential for establishing a productive relationship/collaboration with the school during the project?</p>
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			<i>e.g. as a researcher, I have the necessary skills to support students to design a research for investigating an issue in an appropriate manner [research skills]</i>
	W	Weaknesses	<p>What knowledge/skills do you think you lack of but you consider as essential for establishing a productive relationship/collaboration with the school during the project?</p> <p><i>e.g. we have never been active participants in a school project before, so we are not sure of how we can actually contribute to this endeavor [lack of experience in participating in school projects]</i></p>
External attributes (interaction with the environment)	O	Opportunities	<p>What type of opportunities which are offered by teachers/students/school you think might facilitate the establishment of a productive relationship/collaboration during the project?</p> <p><i>e.g. the school is very close to the premises of our company and so we can easily keep contact with them and help them throughout their project [easy access to the school-geographical location]</i></p>
	T	Threats	<p>What type of risks might hinder the establishment of a productive relationship/collaboration during the project while collaborating with the school/ students/ teachers?</p> <p><i>e.g. the procedures followed in our company are complex and automated and so the active participation of students might slow us down [collaboration will slow down the procedures of the company]</i></p>

Table 5: SWOT Interview protocol for societal actors

Protocol of conduct. At the beginning of the interviews, the interviewee(s) will be briefly introduced to the SALL project's overall aims and the Living Lab methodology through discussions with the national coordinators and/or through relevant pitch documents prepared by work packages 2 and 3. Given the educational context but also the covid-19 measures of each participating country (e.g. no third parties are able to visit schools) the data for the two SWOT analyses can be collected in multiple ways (e.g. through phone calls, emails, on-line meetings, face-to-face communication) and in different times per participatory level (but before their active participation in a school project). Also, not all teachers, societal actors and schools' administration staff must participate in the interviews; "key players" (1-3 people per participatory level per focus school) will be chosen by national coordinators.

National coordinators can also choose to organize focus groups during a workshop to discuss related issues with a variety of participants to spontaneously facilitate the data collection process and also to support the co-design of the school project. It is essential, however, during this process to provide ample time to all participants to express their opinions regarding all the domains of the SWOT analysis. For example, a SWOT board can be created and participants can use post-it notes to write their different ideas anonymously for each of the domains. Then, the facilitator of the discussion can start a conversation about these ideas with all the participants. When needed, follow-up one-to-one discussions after the workshop (through phone calls, emails, on-line meetings, face-to-face etc.) can enrich the data of the SWOT analysis per participatory level and also provide the time and space for participants to elaborate on their initial ideas.

Specifically, the following sequential steps will be implemented by partners for the SWOT analysis for all participatory levels:

- a. Inform the participants about the project (discussions, pitch documents etc.) and the reflection process they will participate in for supporting the planning of their project (i.e. Expectancies SWOT).
- b. Collection of the data from the participants for each focus school. It is suggested to national coordinators to record the discussions (when applicable) to ease the identification of key information for completing the SWOT template.
- c. Each national coordinator prepares one Expectancies SWOT for each focus school with the use of the following template (adaptations can be made if necessary) (see Table 6 for details). In parentheses, the frequency of the mentioned idea will be stated. The examples of ideas in the template are indicative (based on the example of answers in the interview protocols) to facilitate partners understanding of the collection and analysis process. National coordinators will also provide representative quotes from the interviews for ideas presented on the table when applicable.

	Teachers	School	Societal actors (this category can be divided in specific categories)
S	<i>previous experience with similar projects (n=...)</i> <i>knowledge about what motivates societal actors (n=...)</i>	<i>understanding the dynamics between his teaching staff (n=...)</i>	<i>research skills (n=...)</i>
W	<i>low self-efficacy to participate in open activities (n=...)</i>	<i>lack of knowledge on how to attract relevant societal actors (n=...)</i>	<i>lack of experience in participating in school projects (n=...)</i>
O	<i>provision of extra time for organization purposes (n=...)</i>	<i>reschedules for facilitating collaboration between teachers of the same school (n=...)</i>	<i>easy access to the school-geographical location (n=...)</i>
T	<i>lack of interest for long-term participation unless there is a profit for them (n=...)</i>	<i>restrictions of the national curriculum (n=...)</i>	<i>collaboration will slow down the procedures of the company (n=...)</i>

Table 6: A simplistic example of a SWOT template to be used by partners for presenting data

- d. The coordinators of this work package will present the main trends per country but also identify common trends for all the focus schools to make targeted suggestions for the implementation phase and the SALL methodology. Also, the national coordinators will be informed about the results to better support their schools. An independent researcher will also review about 20% of the data and reliability measures (Cohen's Kappa) will be calculated.
- e. At the end of the school's implementations, steps a-c will be followed for the implementation of Impact SWOT. Then, the coordinators of this work package will present the main trends per country by additionally making comparisons with the Expectancies SWOT and also identifying common trends in all focus schools. These findings will indicate the impact of the SALL methodology per participatory level and also the interactions between the participants in order to make targeted adjustments to the SALL methodology. Furthermore, the SWOT analyses will also guide the development of a lighter version of evaluation tools (i.e. beliefs questionnaire towards the SALL approach) for year 2 and 3 of the project.

2.2.3. Case Studies

The case study reports will be created by the national coordinators of each country (one per school project) following a specific format (see table below) in order to be able to describe the projects implemented by each school (type of involvement of participants in the project, the type of projects implemented, time devoted in the projects, etc.) and to identify frequent challenges and best practices for implementing a living lab project in the context of food system in order to enhance the SALL methodology. The case studies will also be used by other work packages in order to present the work of schools in the wider community.

Starting point	Prior knowledge/skills of the school/teachers/students that facilitated the implementations -prior participation in OSOS or similar projects in the context of open schooling? -prior knowledge in the context of the food system? ...
Aims	Aims of the project (product/service) What was the main objective of the project? What was the relevance of the project to students' everyday life and the community? ...
Societal actors	Define level of involvement of different societal actors What societal actors got involved in the project, in what way and for how long? Define the level of participation of each societal actor involved in the project by using the levels of participation presented in the handbook <i>Living Lab: A New Form of Relationship with the Public</i> (Inmediants, 2014, pg. 9-10).
Implementation	What processes were followed in order to achieve the aim of their project? (description will be based on the stages of the Living Lab methodology suggested)
Reflection	Reflect on the overall outcome of the project What worked and what did not during each step of the Living lab methodology? What was its value for the participants? What was the feedback from the participants? ...

Table 7: The format of the case studies reports

The case study reports will be written by national coordinators at the end of the schools' implementations and delivered to the coordinators of WP5 for the purposes of meta-analysis described earlier. Apart from the main description, the case studies can also entail pictures, videos, dialogues with participants etc. All necessary information will be collected in various ways (e.g. face-to-face communication, school visits, participation in school events, emails, online meetings, phone calls) throughout the implementations.

2.2.4. Beliefs questionnaire towards SALL approach

The "Beliefs questionnaire towards SALL approach" will be developed at the end of year 1. It will be based mainly on the SWOT analyses and specifically, the main trends identified for each participation level. The main objective of this questionnaire will be to identify whether similar trends in the beliefs of

the participants continued to exist concerning all the domains of the SWOT analyses (i.e. strengths, weaknesses, opportunities and threats) after the refinement of the SALL methodology during year 1 (as a result of the in-depth study). This questionnaire will be designed to contain a number of items in Likert scale in order to be easier to administer to the wider community of participants. Thus, it will enhance our understanding about whether the optimization of the SALL methodology was successful and also whether the threats and weaknesses of the implementation of the SALL methodology in a school setting were minimized. It is possible that different beliefs questionnaires will be developed for each participatory level, since their role and engagement in the projects will vary. The Beliefs questionnaire(s) towards SALL approach will be presented in Deliverable 5.2: Interim Evaluation Report.

2.2.5. Additional data to be collected

Information regarding the gender and educational level of the students will be collected, the gender, subject discipline and educational level of the participating teachers, as well as information about the type of societal actors participating. Also, traffic data from the SALL's platform and website will be collected (number of visitors, registrations, communities created etc).

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4. Appendices

4.1. Appendix I. Living Lab project's identified in phase II of the development of the Evaluation Framework

Note: The information presented here derived from the project's websites and/or related deliverables. It was retrieved during November-December 2020.

Table 8: Living Lab project's description and evaluation process identified via partners' expertise and online search

Title	Link	Year	Main concept/rationale	Implementation	Age / Educ. Level	Participants of the Living Lab	Evaluation procedures and tools	Main Findings
DESCI project	http://www.desci.eu/	2016 - 2018	The “Developing and Evaluating Skills for Creativity and Innovation” (DESCI) project promotes alternating training in secondary School system based on the Living Lab approach, adopting participatory design methodologies, connecting School, Enterprise, Research and Territory. DESCi aims to strengthen the links between educational systems and the world of work, relating training programmes to the cultural, social and economic development of the territory. In DESCi the Living Lab approach is present in three, interrelated, environments: <u>Policy Lab for Alternating Training and Consortium</u> : coordination of the network of organizations (schools, research centers, enterprises) that share knowledges and experiences, that support the implementation of DESCi Alternating Training. First	1st Experimental Middle School of Athens (Greece), Centro de Formacion Somorrostro (Spain), Istituto Tecnico tecnologico Frascati (Italy)	Secondary school	Schools, research, enterprises, territory/local context, communities	<u>3 levels of assessment</u> : o Student assessment o Scenarios assessment o Process assessment DESCi Evaluation Toolkit, provides the tools for the assessment and self-assessment of the students and for the evaluation of the processes. The schools will be in charge of implementing the evaluation process and data collection in each of the evaluation phases involving the three profiles (students, teachers and tutors) according to: <u>EX ANTE</u> : AIM - Assessing the past experiences and the expectations of all alternating training actors. WHEN - At the beginning of DESCi project. TOOLS - 4 questionnaires: for students, for families, for external tutors (research institutions and companies). <u>ONGOING</u> : AIM - Assessing the development of the alternating training and the improvement of students'	The school becomes Living Lab for the territory/local community connected at the European level, that means that the school becomes “incubator” of innovation and creativity, a co-working space where the students develop deliveries (products or services) of social utility, under the mentorship of research bodies, associations and companies.

		<p>participants are the DESCi Partner (DESCi Consortium).</p> <p><u>Teachers' Living Lab</u> – the Living Lab which is activated in each school, through which the teachers plan, realize and evaluate the implementation scenarios for their school.</p> <p><u>Students' Living Lab</u> – into the Alternating Training the students can activate a Living Lab for developing innovative industrial delivery, under the tutoring of the teachers, enterprises and researchers.</p>			<p>competences during the alternating training.</p> <p>WHEN - In the middle of the testing phase.</p> <p>TOOLS - Questionnaires and rubric: the first one for students and the second for teachers.</p> <p><u>EX POST:</u></p> <p>AIM - Assessing the alternating training process and the improvement of students' competences/ skills.</p> <p>WHEN - At the end of the testing phase.</p> <p>TOOLS - The same questionnaires used in the EX ANTE complemented with new items.</p> <p>The <u>final evaluation</u> has 3 main typologies:</p> <p><i>Delivery Assessment:</i> Students evaluate the delivery that they produced to decide on the future exploitation: commercialization (start-up) or free diffusion (if open). A large variety of methodologies can be used and coexist (swot, business model, living lab elements by check list). In Living Lab approach one of the main feature is the user involvement in evaluating the delivery. The users evaluate the delivery produced by the students.</p> <p><i>Students' assessment:</i> The teachers evaluate the students' skills. The evaluation can be exogenous, based on delivery assessment by users, or endogenous, based on the</p>	
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							<p>observation grid filled by internal and external tutors. The students also have means to self-evaluate.</p> <p><i>Process assessment:</i> The teachers can plan activities to make the students evaluate the training process, and their experience, specially aimed to measure their satisfaction in order to improve the training in the future.</p>	
SmartIES	https://www.ltu.se/cms_fs/1.101555!/file/LivingLabsMethodologyBookweb.pdf	2010 - 2012	<p>The goal has been to make the Living Lab Key Principles and the application of them more visible and easier to use. The objective of the SmartIES project was to exchange, analyse and disseminate Smart City Living Lab pilot initiatives in the area of Energy saving towards successful implementation of a Nordic transnational best-practice Smart City Living Lab pilot.</p>	<p>Projects in Iceland, Sweden, Norway, Denmark, Lithuania</p>	Citizens	<p>Companies, users, public organisations, researchers</p>	<p><u>Evaluation within the Living Lab approach:</u> The value of Living Lab operations can be assessed with the five Living Lab Key Principles (Value, Influence, Sustainability, Openness, Realism)</p> <p>THE FORMIT PROCESS (three iterative cycles following the FormIT Living Lab methodology with a strong focus on the five Key Principles)</p> <p>Concept design cycle: Evaluate Utility and Usefulness</p> <p>Prototype design cycle: Evaluate Usability</p> <p>Innovation design cycle: Evaluate User Experience</p> <p><u>Evaluation of the project:</u> 2 Case studies</p>	<p>As a result, the FormIT methodology has been used and evaluated and thereby also strengthened to better embody the five Key Principles.</p>
Living Schools Lab	http://isl.eun.org/home;sessionid=010CA1236A8C08A48FADC27	2014	<p>It aims to create:</p> <ul style="list-style-type: none"> - A sustainable, growing network of primary and secondary schools, based around regional clusters, that showcase and share best practice and ways to successfully embed the use of technology in teaching and learning (T&L) across the whole school. 	<p>Schools in Austria, Czech Republic, Finland, France, Ireland, Italy, Lithuania, Norway, Portugal, United Kingdom</p>	Schools	Not mentioned	<p><u>Evaluation within the Living Lab approach:</u> They created a Living Schools Lab (LSL) Validation Manual to offer a model and tools which any organisation can replicate or adapt if it wishes to set up and run its own school pilot. The Validation Manual includes the validation methodology, operational process, validation scenarios, (covering coordination, technical support, incentives for</p>	<p>Living Schools Lab project promoted a whole-school approach to ICT use, scaling up best practices in the use of ICT between schools with various levels of technological proficiency.</p>

	B9E86 41FB	<ul style="list-style-type: none"> - A strong community of practice, with supporting continuous professional development opportunities for teachers. - Opportunities for schools to get involved in action-based research, creating links with outside partners including industry and other pan-European projects. - Validation methodologies and a new turnkey validation service whereby schools in the network will be available to test and evaluate results of European Commission funded projects along with technologies, services and content provided by other stakeholders. 			<p>participating schools/teachers, evaluation instruments, developing communities of practice, organisation of validation workshops and summer schools etc.) for both large and smaller scale school pilots, to help stakeholders consider different types of validations and tools and templates to use and adapt to fit different validation requirements.</p> <p><u>Evaluation of the project:</u> <i>Evaluation Objectives:</i></p> <ul style="list-style-type: none"> • Analyse and understand the project's current LSL schools' network operations • Review the project's research with schools and other stakeholders on the creation of a schools' validation service • Review the exploitation plans for the onward growth and sustainability of the network • Identify roadblocks that may impact the growth of the network • Develop a set of recommendations to help overcome the roadblocks <p><i>Methodology:</i> Desk-Based, On-line Interviews, On-line questionnaire, Focus Group Follow up (calls and questions), Analysis of key documentation, Analysis of social media analytics. Observation visits (look into schools from across 12 countries) and discussions at the national focus groups, and with senior management in schools and in project partner organisations.</p> <p>Country case studies: Produced with</p>	
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							the support of the national coordinators.	
Analyzing Co-Creation in Educational Living Labs using the Knowledge Appropriation Model	http://ceur-ws.org/Vol-2190/CC-TEL_2018_paper_1.pdf	Not mentioned	They introduce the knowledge appropriation model as an analytical framework to study co-creation processes in School-University Partnerships. The model explains transformative learning processes in the context of innovation adoption in organizations, communities, groups and individuals and how they are interconnected.	Educational Living Labs currently being developed for introducing innovative teaching practices in STEM subjects in secondary schools in Estonia.	Secondary School	<p>Main stakeholders: teachers, educational researchers</p> <p>Case 1: educational researchers, participating teachers, educational technologists, education schools, pre-service teachers</p> <p>Case 2: experts, teachers</p> <p>Case 3: researchers, teachers, learners, designers, developers and zoological experts</p>	<p>Describing several cases of Educational Living Labs currently being developed for introducing innovative teaching practices in STEM subjects in secondary schools.</p> <p>Case 1: pilot study, lesson-organizing workflows developed by participants shared via in-depth interviews with researchers, after the end of the pilot another roundtable with participants was conducted to get feedback. A month after the end of the pilot national standardized test scores for mathematics confirmed that there was a positive difference between results of the experimental and control classes.</p> <p>Case 2: cross-validation of co-created ILS(inquiry-learning spaces), Go-Lab provides teachers and students with learning analytics solutions that help them monitor, assess and reflect on the learning process</p> <p>Case 3: A series of pilot studies in three different countries were conducted in an iterative manner. The evidence about the teachers' and students' experiences was collected through online questionnaires, interviews, observation notes and feedback sessions.</p>	They derive a research model that relates co-creation in Living Labs to the eventual adoption of learning innovation in schools.

Towards a Living Lab to support evidence-based educational research and innovation	http://ceur-ws.org/Vol-1925/paper04.pdf	Not mentioned	Their proposal is to exploit Living Labs as adaptable platforms where researchers and practitioners collaborate to carry out evidence-based research and innovation on educational processes.	Pilot study, that is being carried out at Tallinn University (Estonia), in which a Living Lab supported a researcher and two teachers to introduce Learning Analytics in their classroom (master level course).	Higher education	Researchers, educational practitioners	<p><u>Evaluation within the Living Lab approach:</u> There are two iterative cycles. The phases related to evaluation in the first cycle are Intervention and Evaluation Design; Evaluation and Reflection and in the second cycle are Reflection; Social Validation. These two cycles are interconnected: the reflection that emerges in the research process should be validated by a bigger community of teachers; at the same time, this social validation may engage new teachers to participate in further iterations of the research process. There is infrastructure that should collect data related to the use of the different applications, which can then be analyzed in order to assess the research and innovation process that occur in the Living Lab. Tools: Support with GRAASP focussed on the Intervention and Evaluation Design, Enactment, Evaluation and Reflection phases. They embedded an evaluation framework (questionnaire based on the Hopscotch model and on frameworks of Learning Analytics teacher-led innovations) into GRAASP to support the Intervention and Evaluation Design phase.</p> <p><u>Evaluation of the project:</u> They contacted preliminary study pilot where a Living Lab supports a researcher and two teachers to introduce and adopt Learning Analytics techniques into a course.</p>	Living Labs represent a promising approach to bridge the gap between evidence-based educational research and sustained innovation.
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							They took notes about any relevant incident when the users were using GRAASP. When the Intervention and Evaluation Design phase finished, they interviewed the users about their experience.	
Student living labs as innovation arenas for sustainable tourism	https://www.tandfonline.com/doi/full/10.1080/02508281.2019.1613299?src=ecsys	2019	This paper aims to explore sustainable tourism in relation to the concept of student living labs, defined as spaces for open innovation, co-creation and experimentation in real-life settings with students.	Case 1: Action-oriented master course/thesis project (Sweden), Case 2: Creative arena with incubator (Sweden), Case 3: Action-oriented PhD project (Kenya), Case 4: Significant part of master's course (Kenya), Case 5: Minor part of PhD course (Sweden)	Higher education	Case 1: Master's students, municipality, ideabased sector, residents, local businesses Case 2: Ex-students, start-ups, business coaches, creative industry businesses, academy Case 3: PhD students (multiple disciplines), peers, int. research and knowledge centre, local businesses, residents Case 4:	Some examples of living labs that the author has been involved in are described. Using an ethnographic approach, the empirical material mainly originates from research diaries and notes from participatory observations. The first three labs are cases of action research, where the author and her colleague were embedded in practical work with 1) a municipality, 2) a business incubator and 3) an ecotourism guide group. In these cases, the empirical material also includes interviews with participants involved in the projects. The empirical material from the last two cases are more shallow observations than the previous, concerning projects where students were involved in two completely different contexts: 4) the unstructured, unfamiliar yet deeply engaging Kenyan environment and 5) a research context with established structures and close mentor communication and instruction.	The findings show that tourism living labs offer students opportunities for hands-on engagement in the co-creation and testing of frontier solutions with private, public and civil society sector partners. They also enhance social inclusion, environmental responsibility and lifelong learning. For the tourism industry, labs can offer new knowledge; more, extended and deepened relationships; and opportunities to find an educated workforce.

						Master's students, peers, local organisations , residents Case 5: PhD students, peers, experts in each discipline		
Living Labs in Architecture as Innovation Arenas within Higher Education Institutions	https://core.ac.uk/download/pdf/132530237.pdf	2017	This paper highlights the importance of Living Labs as innovation infrastructures in Higher Education and presents the specific educational experience of LOW3 (prototype solar house operated as a living lab for sustainable architecture and lifestyle) within the institutional framework of UPC, drawing from 5 years of action research regarding pluridisciplinary, experience-based sustainability education.	Living Lab LOW3 – Laboratory for sustainable architecture and lifestyle at the ETSAV Campus at Sant Cugat del Vallès (Barcelona - Spain)	Higher education	Academia, companies, research entities, local administration	Living Lab LOW3 applies a mixed-methods approach with quantitative and qualitative research methods. Phenomenological research has been used in the Live-at-LOW3 experiment, evaluating the experience of students living a sustainable lifestyle in the LOW3 solar house. The tools used are surveys, questionnaires, semi-structured interviews, amongst other formats like video documentaries and participant's videos.	It shows that the diversity of activities related to one single platform like Living Lab LOW3, allows the creation of synergies between actors, programs and projects.

CIRC4LIFE	https://www.circ4life.eu/what-are-living-labs	2018 - 2021	The main concept is to develop and implement a circular economy approach for sustainable products and services through their value and supply chains. The aim is to develop a common framework and implementation plan for Living Labs, and to coordinate end-user and stakeholder involvement in the Living Lab activities. Living Labs is a concept used as part of the stakeholder engagement process in this project in order to test in a real life setting new products or services.	Industries in UK, Spain, Basque Country	Citizens	Not mentioned	<p>According to developed framework, each stage of an innovation process is implemented based on iterative rounds consisting of four steps: explore, co-create, implement, and evaluate. The number and duration of the iterations varies depending on the development task. Each round lasts approximately 4 months. Consortium meetings are used as a milestone to evaluate the results of each round, and adjust Living Lab plans.</p> <p>TESTING: Validating and evaluating the co-created concepts and alternative options in real life demonstration settings. Omitting the solutions which do have market acceptance.</p> <p>EVALUATION: Continue validating and evaluating the co-created concepts and alternative options in real life demonstration settings. Scalability testing to ensure performance.</p> <p>VALIDATION: Summarizing and reporting the co-created concepts and alternative options in real life demonstration settings. Preparations for 2nd Innovation Camp and selecting the final showcases.</p> <p>OIC(Open Innovation Camp) is used as the final stage of CIRC4Life Living Labs, as a validation tool for developed solutions. OIC is a “co-</p>	The CIRC4Life Living Lab is used both as a methodological approach towards development of Circular Economy Business Models, and as a process of engaging stakeholders in a systematic way.
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							<p>creation sprint type of multi-day event grounded on an open innovation 2.0 principles where a group of carefully selected stakeholders having diverse but complimentary expertise creates a common understanding of (a complex societal) challenge and work together to develop in a co-creative manner user centered concepts and solutions to pre-defined challenges in a set timeframe”.</p>	
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4.2. Appendix II. Students Questionnaires – Science Attitudes Questionnaire

Science Attitudes Questionnaire

Demographic Information:

School: _____

Grade: _____

Gender: ☐ Male ☐ Female

For the purpose of keeping the questionnaires anonymous and matching your answers before and after your teacher's implementations, you will create a personal code following these steps: write the first 2 letters of your mother's name and then the first two letters of your father's name, 2 numbers for the month and 2 numbers for the day of your mother's birthday.

Example: mother's name: Maria, father's name: Filip and the mother was born in the 12th of February. So, the code is MAFI0212

Personal code: _____

Directions: Please indicate with an X how strongly you disagree or agree with each statement.

#	Items	1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree
1	The science I learn at school is relevant to my life					
2	Learning science is interesting					
3	I put enough effort into learning science					
4	I like science practical work because you don't know what will happen					

5	Learning science will help me get a good job					
6	I am confident I will do well on science tests					
7	Knowing science will give me a career advantage					
8	I would like more practical work in my science lessons.					
9	Learning science makes my life more meaningful					
10	Understanding science will benefit me in my future career					
11	I am a member / I would like to be a member of a science club					
12	I believe I can master science knowledge and skills					
13	I prepare well for science tests and labs					
14	I am curious about discoveries in science					
15	I believe I can earn a good grade in science					
16	I would like to do more science activities outside school					
17	I am sure I can understand science					
18	I study hard to learn science					
19	My career will involve science					
20	I will use science problem-solving skills in my career					
21	I enjoy learning science					
22	It is exciting to learn about new things happening in science					
23	I am confident I will do well on science labs and projects					
24	I like reading science magazines and books in my free time.					

25	I like watching science programmes on TV, YouTube channels etc.					
26	Practical work in science is exciting					
27	I use strategies (e.g. experiments, online research) to learn science well					
28	I like practical work in science because I can decide what to do myself.					
29	I spend a lot of time learning science					
30	We learn science better when we do practical work					

4.3. Appendix III. Students Questionnaires- Civic Engagement

Civic Engagement Questionnaire

Demographic information:

School: _____

Grade: _____

Gender: ☐ Male ☐ Female

For the purpose of keeping the questionnaires anonymous and matching your answers before and after your teacher's implementations, you will create a personal code following these steps: write the first 2 letters of your mother's name and then the first two letters of your father's name, 2 numbers for the month and 2 numbers for the day of your mother's birthday.

Example: mother's name: Maria, father's name: Filip and the mother was born in the 12th of February. So, the code is MAFI0212

Personal code: _____

Directions: Please indicate with an X how strongly you disagree or agree with each statement.

#	Item	1 Strongly disagree	2 Disagree	3 Neither agree nor disagree	4 Agree	5 Strongly agree
1.	I feel like I am a part of a community ¹ .					
2.	I pay attention to news events that affect the community.					
3.	Doing something that helps others is important to me.					
4.	I like to help other people, even if it is hard work.					
5.	I know what I can do to help make the community a better place.					
6.	Helping other people is something everyone should do, including me.					
7.	I feel like I can make a difference in the community.					
8.	I try to think of ways to help other people.					

¹ A community is a group of people with commonalities such as norms, religion, values, customs, or identity. Communities may share a sense of place situated in a given geographical area (e.g. a country, village, town, or neighborhood) or in virtual space through communication platforms (from Wikipedia, retrieved 22 November 2020).

9.	It is my responsibility to help improve the community.					
10.	I am or plan to become actively involved in issues that positively affect the community.					
11.	Being concerned about state and local issues is an important responsibility for everybody.					
12.	I participate in activities that help to improve the community.					

SCHOOLS
AS LIVING
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