D 5. 1. EVALUATION PROTOCOL AND INSTRUMENTS

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Table of Contents

1. OBJECTIVE

This document aims to present a detailed protocol for evaluation of lighthouse activities, interactive career talks, and open schooling activities and describe the main phases and the timeline of the evaluation process. It is organized into three main sections.

The first section presents general and brief information about the three main phases of the evaluation process. The second section explains the evaluation procedure to be followed in each type of activity: lighthouse activities, interactive career talks, and open schooling activities. The third section includes the evaluation instruments developed for each type of activity. Also in this section, it is included the "Observation Template" developed by the IE-Lisboa group that supports the evaluation of the lighthouse activities conducted during the pilot phase.

2. EVALUATION PHASES AND TIMELINE

2.1 T5.1 Development of evaluation instruments (m1-14) (January 2023-February 2024)

M5.1. The instruments will be piloted during m7-12 (July 2023-December 2024) and again refined if deemed necessary.

Role of participants: The country partners will give feedback to the evaluation instruments.

2.2 T5.2 Data collection (m15-32) (March 2024-August 2025)

In each country, we will collect data after lighthouse activities and interactive career talks through the post-test and before and after open schooling activities through the pre-test/post-test. Additionally, we will conduct individual interviews with teachers and focus groups with students on open schooling activities. For collecting and evaluating the data we use a data protection compliant, digital, coded-anonymized system. This enables us to examine the participant behavior and beliefs in compliance with the European (European Union, 2016) and national data protection acts (Federal Ministry of Justice, 2017).

Role of participants: The country partners will be responsible for the local data collection.

2.3 T5.3 Data evaluation (m27-35) (March 2025-November 2025)

The questionnaires will be evaluated centrally by UNIC, whilst every single interview will be evaluated / analysed in the respective country due to language reasons. Based on the interview analysis each country team will write one individual country-case study. For this purpose, UNIC will develop a framework with questions for the case study (see above T5.1). UNIC will evaluate

these country-case studies internationally and write a cross-case study. The results of the evaluation will be discussed in a validation workshop with the consortium. In the end, all results (of the quantitative questionnaires and the case studies) will be summarized in the evaluation report.

Role of participants: Country partners will be responsible writing the case studies, with science education experts from the consortium taking the lead. The WP lead will evaluate the questionnaires centrally and write the cross-case study.

In Figure 1 (Appendix VII) you can see a scheme of the timeline of the evaluation of the activities. The 3 main moments of the evaluation are described below:

3. EVALUATION PROCEDURE

This section presents the information about the implementation dates and the evaluation procedure for each activity: lighthouse activities (Blades, 2011; UNFCCC, 2017), career talks (Woods-Townsend *et al.* 2016), and open schooling activities (European Union, 2015; Sotiriou *et al.*, 2017; 2021; Bogner & Sotiriou, 2023).

3.1 Lighthouse activities (LHA)

- **Piloting phase:** from mid-November 2023 until the end of March 2024. 3 per country.
- **Implementation phase:** until March 2025 you need to complete 27 LHA (Table 1), after that is going to be extra.
- Evaluation: The LHA will be evaluated after the activity (post-test only) by means of questionnaires (Table 2). The questionnaires will be filled in by students (see Appendix I) as well as by teachers, parents and scientists (see Appendix II). The "Observation Template" for LHA can be consulted in Appendix VI.

3.2 Interactive career talks (ICT)

- **Piloting phase:** from mid-November 2023 until the end of March 2024. 3 per country (Table 1).
- **Implementation:** from January 2023 to March 2024. 8 ICT per country (Table 1).
- Evaluation: The ICT will be evaluated after the activity (post-test only) by means of the same questionnaire as for LHA (Table 2). The questionnaires will be filled in by students (see Appendix I) as well as by teachers, parents and scientists (see Appendix II).

3.3 Open schooling activities (OSA)

- **Piloting phase:** from mid-November 2023 until the end of March 2024. Although it is not necessary to carry out OSA during the piloting phase, OSA can already begin to be carried out if the teachers would like to and feel ready.
- **Implementation:** from March 2024 to February 2025. 40 per country (Table 1).
- **Evaluation:** The OSA will be evaluated before and after the activity (pre-test and post-test) by means of the same questionnaire as for LHA and ICT **(Table 2)**. The questionnaires will be filled in by students (see Appendix I) as well as by teachers, parents and scientists (see Appendix II).

In addition, case studies will be developed for the evaluation of OSA. In these case studies, interviews with teachers and focus groups with students will be conducted. Each country will develop 1 case study. Each case study consists of 3 individual interviews with teachers (before and after the OSA) and a focus group with students (after the OSA).

As for the teacher interviews, it is intended that the initial interview (before the OSA) will be shorter than the final one (after the OSA), which will be more in-depth, as participation in interviews requires a great effort and it could be counterproductive to ask for two in-depth interviews. For this reason, it is recommended to conduct the initial interview (appendix III) in writing, so that teachers can take as much time as they wish to submit their answers. In both cases (the initial interview in Appendix III and the retrospective interview in Appendix IV) it is recommended that the teachers (in the case of Appendix III) and the interviewers (in the case of Appendix IV) have both the main questions and the supporting questions at their disposal, as these may be useful for them to provide/obtain more in-depth information.

As for the focus groups with students, they will be conducted only after the activity (retrospective focus group only). The idea of this focus group is to be able to compare the information provided by the teachers in the retrospective interviews with that provided by the students in the focus group, in order to contrast both perceptions (see Appendix V with the questions for the focus group).

Table 1. Number of activities and participants.

Type of activity	Nº of activities/country	Nº of participants/activity	Nº of participants/country	Europe
Lighthouse activities	27	10-15	≈300	≈1500
Open schooling activities	40	5-8	≈250	≈1250
Interactive career talks	11	10-15	≈120	≈600
Local fairs	2	30-50	60-100	300-500

Table 2. Evaluation instruments to be used for each type of activity.

Type of activity	Pre-test	Post-test	Observation template	Initial individual interview	Retrospective individual interview	Retrospective focus group
Lighthouse activities	----	Students Parents Teachers Scientists	During the activity	----	----	----
Interactive career talks[1]	----	Students Parents Teachers Scientists	----	----	----	----
Open schooling activities	Students Parents Teachers Scientists	Students Parents Teachers Scientists	----	3 with teachers	3 with teachers	1 with students
Local fairs	----	Students Parents Teachers Scientists	----	----	----	----

4. REFERENCES

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[1] Everyone present in the ICT should complete the questionnaire. In some cases parents might participate in these talks as these might take place outside of the school time.

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5. APPENDIX

5.1 Appendix I. Students' questionnaire

The purpose of the questionnaire is:
- to evaluate the different activities (lighthouse activities, open schooling, interactive career talks),
- to evaluate whether students' self-efficacy changes with the participation in the different activities,
- to evaluate whether students' attitudes towards science change with the participation in the different activities,
- to evaluate whether students' career aspirations are affected by the participation in the different activities,
- to explore whether parents' background (profession, experiences with parents) affects students' career choices.

Explaining the logic:
- The questionnaire is brief as some of the activities are brief as well (i.e. the interactive career talks)
- We want to track students' participation in the different activities and this is why we want to create a code name,
- The questionnaire was modified based on suggestions from partners during the kick-off meeting. We tried to incorporate all suggestions while at the same time maintaining a short length for the questionnaire.
- A previous version of the questionnaire was piloted with 34 students (except for the last part that has to do with the evaluation of the activity they will attend). The students were 13-16 year old. Based on the piloting some questions were modified.

Students' questionnaire

Part A. Background information

Code Name: … … … … … … … [the initial of your name/the number of the day you were born (i.e. if it was July 15 write 15)/the initial of your mother's name]
Age:
Gender:
Mothers' level of education:
Fathers' level of education:

I participate in science-related activities, such as: (you can check more than one)
- science museums ☐ Frecuency: … … … …
- science festivals ☐ Frecuency: … … … …
- science-related education programs ☐ Frecuency: … … … …
- field trips ☐ Frecuency: … … … …
- astronomy observations ☐ Frecuency: … … … …
- other (please indicate) ☐ Frecuency: … … … …
- none of the above ☐ Frecuency: … … … …

Where do you gain scientific knowledge from? (you can check more than one)
- media/online ☐
- school ☐
- parents ☐
- friend ☐
- activities happening out of school ☐

Type of activity you are attending (you can check only one):
Lighthouse activity ☐ Open schooling activity ☐ Interactive career talks ☐ Local science fairs ☐

All questions that follow in part B are about science. Which subject comes to mind when you listen to the word science? Answer the questions in Part B having this subject in mind (you can check more than one)
Biology ☐ Chemistry ☐ Physics ☐ Mathematics ☐ Other/s: … … … …

7

Part B. Attitudes and beliefs towards science

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)

Statements	1	2	3	4	5
1. I enjoy learning science					
2. I wish I did not have to study science					
3. Science is boring					
4. I learn many interesting things in science					
5. I look forward to learning science in school					
6. Science teaches me how things in the world work					
7. I like to do science experiments					
8. Science is one of my favorite subjects					
9. Learning science will help me in my daily life					
10. I need to do well in science to get the job I want					

Part C. Self-efficacy towards science

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)

Statements	1	2	3	4	5
1. Science is harder for me than for many of my classmates					
2. Science is harder for me than any other subject					
3. I can understand scientific concepts					
4. I can use scientific concepts to answer questions					
5. I can conduct scientific experiments					
6. I can critically analyze scientific information and draw conclusions					
7. I can communicate effectively about scientific topics with others					
8. I can solve problems using scientific methods and techniques					
9. I can apply scientific principles to real-world situations					
10. I can learn and use scientific skills, such as data analysis.					
11. I can engage in scientific inquiry and ask relevant research questions					
12. I am confident I can succeed in a scientific career					
13. I am confident I can successfully pursue studies in science					

Part D. Interest in science studies and science career

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)					
Statements	**1**	**2**	**3**	**4**	**5**
1. Making an effort in science is worth it because this will help me acquire the skills required for my future career					
2. What I learn in science is important because I need this for what I want to do later on.					
3. The skills/knowledge learn in science will help me to get a job.					
4. My family would like me to choose a science career.					
5. I am interested in careers that use science, mathematics or technology.					
6. I would like to study science related fields at university.					
7. I have a role model working in science related field					
8. A family member of mine works in a science related field					
9. I enjoy talking to scientists.					

Part E. Evaluation of activity

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)					
This activity:	**1**	**2**	**3**	**4**	**5**
1. Was fascinating					
2. Helped me learn new concepts					
3. Helped me obtain new skills					
4. Required that I collaborate with other students					
5. Required that I collaborate with scientists					
6. Required that I collaborate with people from industry					
7. Helped me to understand the connection of science to everyday life					
The activity helped me solve a real problem					
The activity helped me participate in decision making					
The activity helped me understand the importance of cooperation between community and scientists					
I had constructive communication with mentors during the activity.					

Part F. Open-ended questions

1. What did you like the most in this activity?

2. What would you like to do differently in this activity?

3. How well did you interact with scientists in the activity? In which way did you interact with them?

4. What did you learn?

5. Further recommendations for improvement of the activity?

10

5.2 Appendix II. Teachers, Parents and Scientists' questionnaire

The purpose of the questionnaire is:
- for teachers, parents, scientists and people from the industry to evaluate the different type of activities in which they participate.

Explaining the logic:
- We tried to keep the questionnaire short because some of the activities are short as well. We will collect more information with the case studies.
- Part A is the same for all participants and then based on the category they choose (i.e. Parent) they will be taken to Part B associated with the roles.
- The code name for parents is indented to link parent with child.
- We received feedback from our local team on this questionnaire but did not pilot it as we need to have an activity to pilot it.

Teachers, Parents and Scientists' questionnaire

[Please provide the evaluation moment: pre-test ☐   post-test ☐]

[Please provide the name of the activity]:

Partner(s) involved in designing the activity

[Please provide the name of the partner(s) involved in the activity]:

[Please add the date]:

Part A. Background information

I participated in the project as a … … … … [parent/teacher/scientist]
IF you are a PARENT, Code Name: …….. [the initial of the name of your child participating in this activity/the number of the day your child were born (i.e. if it was July 15 write 15)/the initial of the mother of this child/the number of the day your child participating in this activity]
FOR the rest, Code Name: … … … … [the initial of your name/the number of the day you were born (i.e. if it was July 15 write 15)/the initial of your mother's name]

Gender:
Age:
Educational level
Number of books at home:
Profession:

I participate with my children in science-related activities, such as: (you can check more than one)
- science museums ☐ Frecuency: … … … …
- science festivals ☐ Frecuency: … … … …
- science-related education programs ☐ Frecuency: … … … …
- field trips ☐ Frecuency: … … … …
- astronomy observations ☐ Frecuency: … … … …
- other (please indicate) ☐ Frecuency: … … … …
- none of the above ☐ Frecuency: … … … …

Type of activity you are attending: (you can check only one):

Lighthouse activity ☐ Open schooling activity ☐ Interactive career talks ☐ Local science fairs ☐

12

Part B. Evaluation of activity for teachers

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)					
Statements	1	2	3	4	5
1. The activity was captivating for the students.					
2. The activity kept students engaged.					
3. The activity taught new ideas that I can integrate into my lessons.					
4. The activity provided opportunities for students to acquire new skills.					
5. The activity fostered teamwork among students.					
6. The activity enabled students to collaborate with scientists or professionals from industry.					
7. The activity demonstrated the practical applications of science in everyday life.					
8. The activity provided a real-world problem that students could solve.					
9. The activity encouraged students to participate in decision-making processes.					
10. The activity highlighted the importance of collaboration between scientists and the community.					
11. I had frequent communication with different stakeholders during the activity.					
12. Beyond this project, I engage with my students in hands on science activities in the class					

Part B. Evaluation of activity for parents

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)					
Statements	1	2	3	4	5
1. The activity was captivating and held my child's interest.					
2. My child learned new ideas from the activity.					
3. The activity helped my child develop new skills.					
4. The activity fostered teamwork among children.					
5. The activity enabled my child to collaborate with scientists or professionals from the industry.					
6. The activity demonstrated the practical applications of science in everyday life.					
7. The activity provided a real-world problem that my child could help solve.					
8. The activity encouraged my child to participate in decision-making processes.					
9. The activity showed the importance of collaboration between scientists and the community.					
10. My child had communication with other participants during the activity.					
11. My child often does hands on activities at home.					

14

Part B. Evaluation of activity for scientists and industry

Please indicate your level of agreement or disagreement on the following statements using a 5-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree" (1= Strongly Disagree, 2= Disagree, 3= Neutral, 4= Agree, 5= Strongly Agree)					
Statements	1	2	3	4	5
1. The activity was captivating and held my interest.					
2. The activity helped me communicate scientific concepts or ideas to students.					
3. The activity provided opportunities for students to acquire new skills.					
4. The activity fostered teamwork and collaboration among students.					
5. The activity enabled me to collaborate with other scientists or professionals from industry.					
6. The activity demonstrated the practical applications of science in everyday life.					
7. The activity provided a real-world problem that could be solved using scientific methods.					
8. The activity encouraged students to participate in decision-making processes.					
9. The activity highlighted the importance of collaboration between scientists and the community.					
10. I had frequent communication with other stakeholders during the activity.					
11. I often get involved with hands on activities with students?					

15

5.3 Appendix III. Teachers' initial interview

The purpose of the teachers initial interview is:
- to obtain general information about their usual teaching practices and what they expect from their participation in the open schooling activity.

Explaining the logic:
- The intention is to be able to contrast this information with that obtained later in the retrospective interview.
- The reason for not conducting this initial interview as exhaustively as the retrospective interview is not to increase the fatigue of the participating teachers, who have to fill in several questionnaires, carry out the open schooling activity and, in some cases, also conduct the retrospective interview.

Duration:
- The length of the initial interview is intended to be between 15 and 30 minutes, it depends on the depth with which teachers answer the questions.

Teachers' initial interview

[Please provide the name of the activity]:

Partner(s) involved in designing the activity
[Please provide the name of the partner(s) involved in the activity]:

[Please add the date]:

Part A. Background information

Code Name: … … … … [the initial of your name/the number of the day you were born (i.e. if it was July 15 write 15)/the initial of your mother's name]
Gender:
Age:
Educational level:
Speciality (e. g. Biology, Physics, etc):
Years of service:

Part B. Questions

1. **Have you ever participated in an open school or similar activity?** IF YES, can you describe (briefly) the activity (topic, place, duration, educational goals, and difficulties found)?

2. **How would you define your classes in terms of approaches, methodologies, contents, resources, contextualization, etc.**
   (You can comment on questions such as whether your classes are usually expository or participative, whether you stick to textbook content or use other sources, whether you focus on teaching content or also procedures and/or attitudes, whether you usually deal with current/media/conflictive issues in the classroom, whether you collaborate with other people - such as other teachers, professionals, disseminators, associations, administrations, etc. - for one or more of your classes, etc.).

3. **What do you expect from your participation in the open schooling activity?**
   (You can comment on questions such as whether you expect students to be more engaged than they usually are in class or not, whether you think they will be more focused/motivated/interested or less than usual, whether you think it can help you as a teacher and, if so, which ones, whether you think this kind of activity can help you to handle some problems you usually encounter in the classroom and, if so, which ones - if you have had to deal with problems related to gender issues, please comment on them -, whether you expect to have to spend more time on this activity than on other activities you usually do in class, how you think your school, workmates and parents will receive the activity, etc.).

17

5.4 Appendix IV. Teachers' retrospective interview

The purpose of the teachers' retrospective interview is:
- for teachers to evaluate their perceptions about the open schooling activities, as a framework for the case studies.

Explaining the logic:
- As it said in the project document: *"The retrospective interviews with teachers will contain questions such as the value of open schooling, impact on students and community, the willingness of continuing with open schooling, support needed for open schooling and so on. We deliberately choose an interview with teachers to get a more in-depth insight on open schooling."*. For these reasons, we have organised the questions based on these 4 aspects: value of open schooling, impact on students and community, willingness of continuing with open schooling and support needed for open schooling. We also consider it necessary to include questions about: influence of the previous activities (interactive career talks and lighthouse activities) in the open schooling activity and gender issues.
- Part A is the same as in the questionnaires, although new questions on years of service and specialization have been included.
- The code name is indented to link questionnaires with interviews.

Duration:
- The length of the retrospective interview is intended to be around 1 hour.

Teachers' retrospective interview

[Please provide the name of the activity]:

Partner(s) involved in designing the activity

[Please provide the name of the partner(s) involved in the activity]:

[Please add the date]:

- ### Part A. Background information

  Code Name: … … … … [the initial of your name/the number of the day you were born (i.e. if it was July 15 write 15)/the initial of your mother's name]
  Gender:
  Age:
  Educational level:
  Specialization:
  Years of service:

- ### Part B. Value of open schooling

  Possible research question 1: According to the participating teachers, what are the main benefits of open schooling activities for themselves, the students, the parents, the rest of the participants and the community?

  1. **What do you consider as the most valuable aspect of open schooling activities for you as a teacher, for the students, for the parents and for the rest of the community?**

  Supporting questions (S.Q.) for interviewers:

  a. What was the most valuable insight you gained via your participation in the open schooling activity?
  b. Has the whole experience affected your personal/professional development? In which ways?
  c. Have you noticed any changes in your teaching approach, after your participation in the program?
  d. Were you able to make connections between the community problems and the curriculum?
  e. In your opinion, what was the most valuable insight the students gained via their participation in the open schooling activity?

f. Were the students able to see connections between the community problems and the curriculum?

g. In your opinion, what was the most valuable insight the parents gained via their participation in the open schooling activity?

h. In your opinion, what was the most valuable insight the community gained via their participation in the open schooling activity?

i. Has the open schooling activity helped to identify and address the local problems of the community? Or was it already known?

Possible research question 2: In the view of the participating teachers, what are the strengths and weaknesses of the relationships formed among the participants (school, parents and the broader community) during the open schooling activities?

2. How do you consider the relationship between the school, the parents and the rest of the community during the participation in the open schooling activity?

Supporting questions for interviewers:

a. What do you consider as the most valuable effects on the relationships between the school, the parents and the rest of the community during the participation in the open schooling activity? Would you highlight any negative aspects?

b. In which group did you perceive the greatest participation during the activity (parents, scientists/professionals/other members of the community)?

c. What kind of synergies or relationships have been established (e.g. collaboration between parents and other members of the community)? Did you expect such synergies to occur?

Possible research question 3: Do participating teachers believe that the open schooling experience conducted has the potential to be utilized as a reusable educational resource?

3. Do you think that the open schooling activity carried out is susceptible to be used in other contexts?

Supporting questions for interviewers:

a. Do you think that the open schooling activity carried out is susceptible to be used in other schools of the country? And in other countries?

b. Do you think that the open school activity carried out is an educational resource that can be used by other teachers?

c. Do you think that the open schooling activity carried out is susceptible to be adapted for other educational levels?

Part C. Impact on students and community

Impact on students

Possible research question 4: According to the participating teachers, has the open schooling activity influenced students' scientific education (learning of scientific content knowledge, scientific skills/competences)?

4. From your point of view, did participation in the open schooling activity affect students' scientific skills/competences?

Supporting questions for interviewers:

a. Has participation influenced students' learning of scientific content knowledge?
b. Has participation influenced students' learning of scientific practices/procedures? E. g., ask questions, hypothesise, collect and analyse data, use scientific concepts in real life problems, etc.)
c. Do you feel that the open schooling activity has helped students learn about the relevance of science to real-life challenges?
d. Do you think the activity has been able to strengthen the students' understanding of and confidence in science as a means of solving problems in modern society?
e. Is open schooling a way of giving prominence to scientific literacy/life-long learning? Why/why not.

Possible research question 5: As per the participating teachers, has the open schooling activity influenced students' motivation, attitudes and self-confidence?

5. From your point of view, did participation in the open schooling activity affect students' motivation/active participation and self-confidence?

Supporting questions for interviewers:

a. Do you think that parental involvement has been a motivating factor for students?
b. Do you think that dealing with local community problems has been a motivating factor for students?
c. Do you think that the challenge of facing and having to propose solutions to local community problems has been a motivating factor for students?
d. Did the students receive feedback from the local population on your proposed solution (shown in the local fair?)? How did they feel about it?

Impact on community

Possible research question 6: According to the participating teachers, has the open schooling activity had an impact on the community?

6. From your point of view, has the open schooling activity had an impact on the community?

Supporting questions for interviewers:

a. Do you think the activity has contributed to the scientific literacy (learning of scientific concepts/practices) of the local adult population?
b. Do you feel that the open schooling activity has helped local people learn about the relevance of science to real-life challenges?
c. Do you think the activity has been able to strengthen the local population's understanding of and confidence in science as a means of solving problems in modern society?
d. How did you perceive the interest of the local population in the solution proposed by the students (shown in the local fair?)?
e. Have you perceived interest from other teachers and/or stakeholders to participate in open schooling activities? IF YES, in which ways are they interested? Have you known about other teachers interested or thinking about participating in/carrying out open schooling activities in the future?

Part D. Willingness of continuing with open schooling

Possible research question 7: Do participating teachers contemplate continuing open schooling activities after their involvement in the project?

7. After your participation in the project, do you plan to continue developing open schooling activities in the future? Explain why.

Supporting questions for interviewers:

a. What kind of support would you ask for in the future to carry out an open schooling activity?
b. Would you consider the formation of a collaborative network of teachers to be useful for the further implementation of open schooling activities? Would you feel more confident in continuing to do so?

Part E. Support needed for open schooling

Possible research question 8: According to participating teachers, how would they evaluate the support received from the project for conducting the open schooling activity?

8. How was the support received from the project to carry out the open schooling activity?

Supporting questions for interviewers:

a. What difficulties have you encountered when designing and implementing the open schooling activity?
b. What was the usefulness of the support packages, the different stakeholders (mentors, Science Education Institutes/local coordinators/Science Research Institutes/Community Institutions/Community institutions/enterprises) and/or the lab equipment resources for designing and developing the open schooling activity?
c. If you had participated in other open schooling or similar activities before participating in this project, what difference do you find between previous experiences and this one?

Possible research question 9: According to participating teachers, how did their working environment (including the school, colleagues, curriculum, etc.) influence their participation in the open schooling activity?

9. Apart from the project, have you received support, or encountered obstacles, from your work environment?

Supporting questions for interviewers:

a. How did you perceive the role of your school in your participation in the program (support or obstacle)?
b. How did you perceive the role of your colleagues in your participation in the program (support or obstacle)?
c. Do you think there is something to be changed in the common teachers' practices to support integration of open schooling approaches?
d. Can curriculum be considered as compatible to support the changes required for developing open schooling activities?

Part F. Gender Issues

According to the participating teachers, how have gender differences been addressed during the open schooling activity?

10. Have you encountered gender differences during the implementation of the open school activity?

<u>Supporting questions for interviewers:</u>

a. Did you find differences between boys and girls during the open schooling activity (interest, motivation, active participation, topics proposed, decision-making processes)?

b. Have you found differences in girls' performance in the open schooling activity compared to more traditional activities (interest, motivation, active participation, topics proposed, decision-making processes)? If so, do you think that open schooling activity has helped you to manage these differences?

c. Did you highlight any issues in relation to the way boys work during the activity? Did you find any differences with respect to their usual way of working in class?

d. Did you find any differences in the relationships girls and boys establish when working? E.g. do they usually mix to work together in class, or do they tend to be grouped by gender? Did you notice any differences in this respect in the open schooling activity?

Part G. Influence of the previous activities in the open schooling activity

Possible research question 11: According to participating teachers, how do they assess the contribution, if any, of the professional talks and/or the lighthouse activity to the development of the open schooling activity?

11. What, if any, do you consider the interactive career talks and/or lighthouse activity have contributed to the development of the open schooling activity (contributing topics, knowledge, possible problems and/or solutions, etc.)?

<u>Supporting questions for interviewers:</u>

a. Do you think that the interactive career talks and/or the lighthouse activity have influenced the students during the open schooling activity (contributing topics, knowledge, procedures, possible problems and/or solutions, etc.?

b. Did the interactive career talks and the lighthouse activity as a teacher help you to lead the open schooling activity?

5.5 Appendix V. Students' focus group

The purpose of the teachers' retrospective interview is:
- for students to express their perceptions about the open schooling activities after their participation.

Explaining the logic:
- The idea of this focus group is to be able to compare the information provided by the teachers in the retrospective interviews with that provided by the students after participating in the activity, in order to contrast both perceptions. The focus group is a way to support, or not, the teachers' perceptions, as evidence to support, or not, the information provided by teachers.
- We recommend conducting the focus group with the students after the retrospective interview with the teachers, in case any modifications need to be made to the focus group to allow us to obtain the necessary information to contrast both sources (teachers and students).
- We have organised the questions based on the same aspects as in the teachers retrospective interviews.
- Part A is only the code name. The code name is indented to link questionnaires with the participants in the focus group.

Duration:
- The length of the focus group is intended to be around 1 hour.

Part A. Background information

Participants

Participant 1. Code Name: …….. [the initial of their name/the number of the day they were born (i.e. if it was July 15 write 15)/the initial of their mother's name]
Participant 2. Code Name: ……..
Participant 3. Code Name: ……..
Participant 4. Code Name: ……..
Participant 5. Code Name: ……..
Participant X. Code Name: ……..
……..

Part B. Value of open schooling

Possible research question 1: In the opinion of the participating students, what are the strengths and weaknesses of the relationships established between the participants (school, parents and the rest of the community) during the open schooling activities?

1. **What is your overall assessment of your participation in the open schooling activity (positive, negative)?**

   Supporting questions (S.Q.) for interviewers:

   a. What would you highlight that you have learned during the activity? What have you done differently from what you usually do in other classroom activities? Have you been able to see connections between the problems in your community and the content you see in class?
   b. How did you perceive your parents' participation in the activity? Do you feel that your parents have learned something from participating in the activity?
   c. How did you perceive your teacher's work in the activity? Did you notice anything different in the way he/she worked compared to other activities you normally do in class?
   d. Do you think that the members of your community have learned something from the work you have done? Do you think that you have contributed something to solving a problem in your community?

Possible research question 2: In the opinion of the participating teachers, what are the strengths and weaknesses of the relationships established between the participants (school, parents and the rest of the community) during the open schooling activities?

2. How do you consider the relationship between the school, the parents and the rest of the community during the participation in the open schooling activity?

Supporting questions for interviewers:

a. What has been the best thing about the collaboration between your school, parents and the rest of the community during the participation in the open schooling activity? Would you highlight any negative aspects?

Possible research question 3: In the opinion of the participating students, do they consider that the open schooling experience carried out is likely to become a reusable educational resource?

3. Do you think that the open schooling activity carried out is susceptible to be used in other contexts?

Supporting questions for interviewers:

a. Do you think that this type of activity could be applied to other problems in your community? Do you think that the open schooling activity carried out could/should be used in other schools in your city/town?

Part C. Impact on students and community

Impact on students

Possible research question 4: In the opinion of the participating students, has the open schooling activity influenced their scientific knowledge (scientific content knowledge, scientific concepts, scientific practices, etc.)?

4. From your point of view, what have you learnt about science during the open schooling activity (concepts, practices, etc.)?

Supporting questions for interviewers:

a. Have you learnt new scientific concepts? (E. g., a word you did not know, a natural phenomenon, things related to environmental problems, etc.)
b. Have you learnt something new about how scientist/science work/s? (E. g., ask questions, hypothesise, collect and analyse data, use scientific concepts/models in real life problems, etc.)

c. After participating in the activity, do you think that science is relevant to the problems we face in our daily lives? Did you think so before?

d. Do you feel that you now have a better understanding of science, and do you trust it as a means of solving the problems of modern society? Did you think so before?

Possible research question 5: In the opinion of the participating students, has the open schooling activity influenced their motivation, attitudes and self-confidence?

5. How did you feel during your participation in the open school activity?

Supporting questions for interviewers:

a. Has it been a motivating activity for you?

b. Did you enjoy participating in the open school activity more than other activities you normally do in class? What kind of activities?

c. Did you try to be actively involved in the activity? Did you offer to participate in as many tasks as you could? Were there any tasks in which you were not very motivated?

d. Did you like your parents' participation in the activity?

e. What was it like to have to deal with a real problem in your community? What positive aspects would you highlight from working with a real problem in your community? Any negative aspects?

f. Have you received feedback from your community about your project? IF SO, what did they think of it?

Impact on community

Possible research question 6: In the opinion of the participating students, has the open schooling activity had an impact on the community?

6. From your point of view, do you think your project has had an impact on your community?

Supporting questions for interviewers:

a. Do you think the activity has contributed to members of your community learning about science (science concepts/practices)? Not only you as students, teachers, parents or other participants, but also other members of your community.

b. Do you think the activity has helped your community to learn about the relevance of science to real problems in our daily lives?

c. Do you think your activity has helped your community to understand and trust science more as a means to solve real problems in our daily lives?

d. How did you perceive the interest of the local population in the solution you proposed in the project?

Part D. Willingness of continuing with open schooling

Possible research question 7: In the opinion of the participating students, would they express interest in participating in open schooling or similar activities again?

7. Following your participation in the activity, would you like to participate in open schooling or similar activities again in the future?

Supporting questions for interviewers:

a. What would you change if you were to participate in an open school activity or similar in the future?
b. Have you missed any kind of help or resources to develop the activity?

Part E. Support needed for open schooling

Possible research question 8: According to the participating students, how do they perceive the support received from the project to carry out the open schooling activity?

8. How was the support received from the project to carry out the open schooling activity?

Supporting questions for interviewers:

a. What difficulties have you encountered during the open schooling activity?
b. How did you perceive the help given by the other participants (teachers, parents, scientists, professionals, etc.)?
c. Were the materials and resources (e.g., laboratory equipment) helpful during the activity?
d. Prior to this project, had you participated in any open schooling activity, or similar? If yes, can you describe (briefly) the activity (topic, place, duration)? Did you like it? Do you find any differences between this one and others you have participated in before?

Possible research question 9: According to the participating students, how did their school environment (including school and teachers) influence their participation in the open schooling activity?

9. Did you receive support other than from your teacher, parents and scientists/professionals?

Supporting questions for interviewers:

a. Have you received support from your school to develop the activity? Have you encountered any obstacles at school?
b. Did other teachers collaborate? What was the opinion of the other teachers about your participation in the activity? Did they help you or did you encounter any obstacles?
c. What do you think should change in the school in order to be able to develop more open school activities?

Part F. Gender Issues

Possible research question 10: In the opinion of the participating students, did they perceive any gender differences during participation in the open schooling activity?

10. Do you think there has been any difference in the participation of girls and boys during the open school activity?

Supporting questions for interviewers:

a. Did you notice any differences between your classmates, boys and girls, during the open schooling activity (interests, participation, topics proposed, way of working)?
b. Have you experienced any conflicts or situations to be resolved that you consider to be gender-related? E.g. Different tasks were assigned to boys and girls without taking into account your preferences, it was assumed that girls or boys could not do a certain task, etc. If so, have there been more of these situations or less than in other more traditional activities you usually do in class?
c. Who do you think participated more actively in the activity (more interest, more motivation, more enthusiasm, etc.), the girls or the boys? Have you noticed any differences in the participation of girls and boys compared to other more traditional activities that you do in class? E.g. girls or boys tend to participate more in class and in the open schooling activity it was the other way around.
d. During the open schooling activity, did you work in mixed groups (girls and boys)? How do you usually work on the activities you usually do in class?

Part G. Influence of the previous activities in the open schooling activity

Possible research question 11: In the opinion of the participating students, how do they consider the contribution, if any, of the interactive career talks and/or the lighthouse activity to the development of the open schooling activity?

11. **Do you consider that the interactive career talks and/or the lighthouse activity have helped you in the development of the open schooling activity (input of issues, knowledge, possible problems and/or solutions, etc.)?**

   <u>Supporting questions for interviewers:</u>

a. Have the interactive career talks and/or the lighthouse activity been useful in developing the open schooling activity?
b. Did they help you to propose/choose topics/problems/solutions?
c. Did you use concepts/procedures/approaches you have seen in those activities during the open schooling activities?

5.6 Appendix VI. Observation template for lighthouse activities

The purpose of gathering data following the "Observation Template" is to support the evaluation of the lighthouse activities conducted during the pilot phase of the project and, consequently, facilitate their future improvement. Additionally, the collected data will be valuable in illustrating international best practices.

The focus of this observation is on both the participants and the activities themselves. Specifically, dimensions A (Conceptual knowledge), B (Skills), and C (Difficulties experienced), described below, are intended to collect data on the conceptual knowledge and skills that participants develop during the implementation of the lighthouse activity. Dimensions D (Relevance), E (Consistency), F (Practicality), and G (Activity effectiveness), on the other hand, aim to gather data on the relevance, consistency, practicality, and effectiveness of the activities.

Next, a template intended to serve as the reference document for the observation of the lighthouse activities implementation is presented.

Observation Template

[Please provide the name of the Lighthouse activity]:

[Please provide the name of the observer]:

Date:
Local:
Partners involved:
Target group:
Number of participants:

A. Conceptual knowledge

The activity promotes the development of conceptual knowledge

Theme	Field notes
Environmental issues - Green Deal	
Digitalization	
Health	

B. Skills

The activity promotes the development of skills.

Skills	Field notes
Attitudes	
Skill in mobilising knowledge	
Communication skills	
Creativity	
Formulating hypotheses	
Appropriate use of technology in solving the problem/challenge	
High order thinking skills (decomposition; abstraction; pattern recognition; error detection; ...)	
Critical thinking skills	

C. Experienced difficulties

The participants experienced difficulties.

Difficulties	Field notes
Overall level of difficulty	
Application of concepts	
Specific actions / processes	

Understanding of the problem / challenge	
Create or identify a valid solution to the problem / challenge	

D. Relevance

The activity is relevant.

Relevance	Field notes
Relevance of the activity according to its objectives	
Applicability of mobilised knowledge to real-life contexts	
Engagement of the participants in the activity (active participation, questions asked, and discussions generated)	
The different subjects are considered and well articulated in the implementation of the activity.	
The activity in its implementation promotes collaborative work between participants.	

E. Consistency

The activity is logically designed.

Consistency	Field notes
Clarity of procedures	
Coherence with the objectives to be achieved	
The activity follows a logical and coherent flow with stages well connected.	
Adequacy of resources, support and instructions	
Time allocated for the activity is adequate	

F. Practicality

The activity is usable in the settings for which it has been designed.

Practicality	Field notes
Allows areas of knowledge to be integrated and mobilized	
Enables the application of competences / skills	
Accessibility of resources	
Time needed to carry out the activity	
Adequate Complexity	
Suitability of space	
Cost	
The activity can be adapted to different contexts or groups of participants	

G. Activity effectiveness

Using the activity results in the desired outcomes.

Effectiveness	Field notes
The activity is aligned with the specific objectives it aims to achieve.	

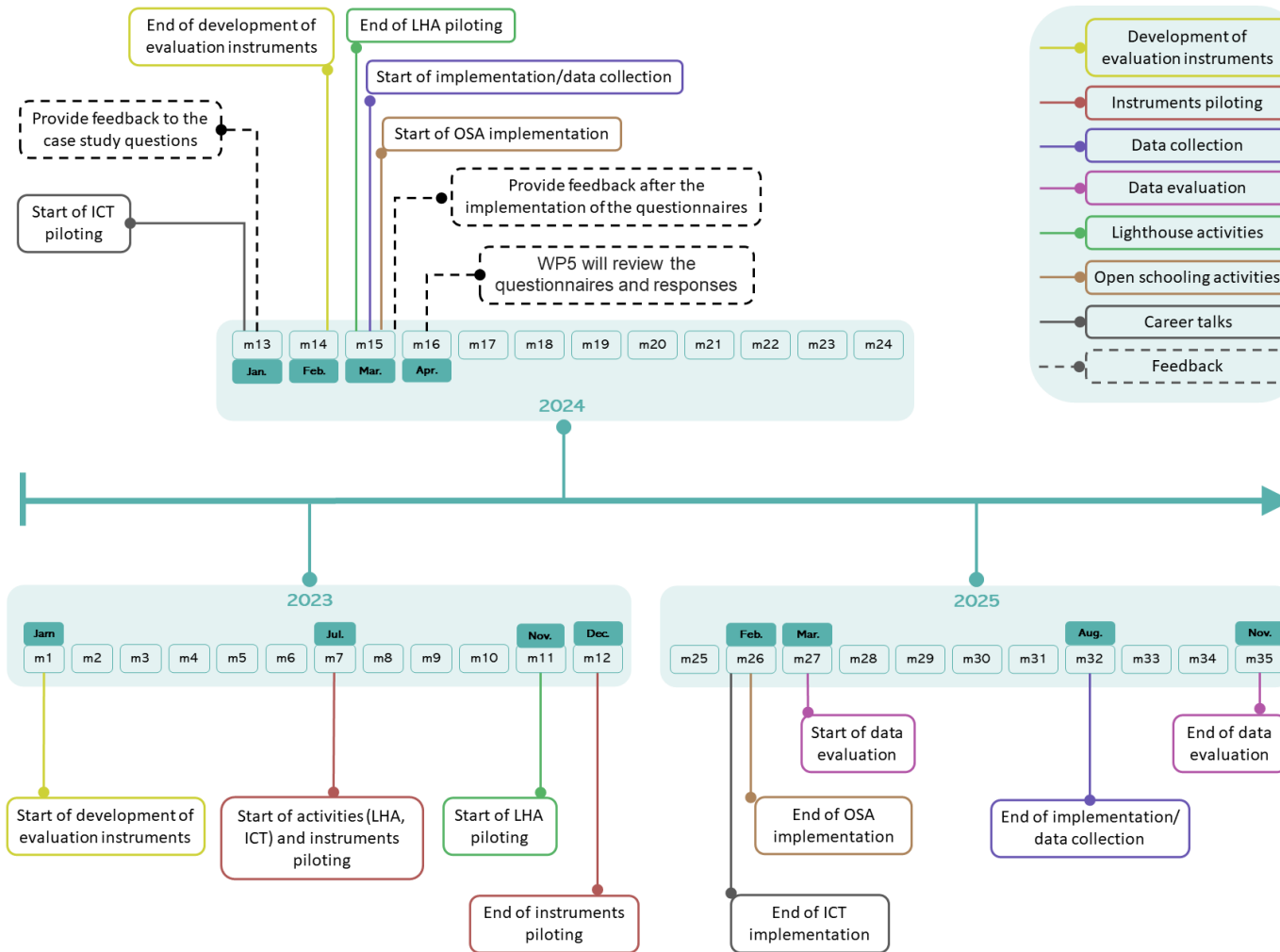|	
The activity is implemented consistently and according to the initial planning.	
The activity intervention has a long-term impact on the participants. The effects last beyond the activity itself.	
Participants' satisfaction with the activity	

Figure 1: Scheme of the timeline of the evaluation of the activities.