Communities for Sciences

Towards Promoting an Inclusive Approach in Science Education

D4.2 – Pilot Operational Manual

Project Acronym	C4S
Project Name	Communities for Science – Towards Promoting an Inclusive Approach in Science Education
Grant Agreement	872104
Start date of the project	01/10/2020
End date of the project	30/09/2023
Related Work Package	WP4
WP Lead Partner	UNIMIB
Other Partner(s) involved	all
Deliverable identifier	D4.2
Deliverable lead beneficiary	All partners
Due date	M12
Date of delivery	30/09/2021
Version	V15
Author	Luisa Zecca & Valeria Cotza (UNIMIB)
Classification	Public

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No 872104

REVISION HISTORY			
Revision	Date	Comments	Author
V1	26/05/2021	First draft	Luisa Zecca & Valeria Cotza (UNIMIB)
V2	24/06/2021	Revision	Gabriel Lemkow, Lluïsa Sort, & Miryam Navarro (FUB)
V3	05/09/2021	Second draft	Luisa Zecca & Valeria Cotza (UNIMIB)
V4	10/09/2021	Third draft	Miryam Navarro, Lluïsa Sort, & Gabriel Lemkow (FUB)
V5	16/09/2021	Revision	Alessandro Porchedu & Simona Vimercati (GiocheriaSesto)
V6	20/09/2021	Revision	Claudia Piovano (Galileo)
V7	20/09/2021	Revision	Kristina Orban (LU)
V8	21/09/2021	Revision	Sarah Scheer (IB)
V9	21/09/2021	Revision	Marlis Henner (EUB)
V10	21/09/2021	Revision	Gabriel Lemkow (FUB)
V11	25/09/2021	Revision	Nadia Koltcheva (NBU) Penka Hristova (NBU)
V12	27/09/2021	Revision	Leen Rosiers, Inge Laenen, Annick Biesmans (EHB)
V13	28/09/2021	Revision	Salvador Simó (UVic-UCC)
V14	29/09/2021	Revision	Martin Wildenberg (RCE)
V15	30/09/2021	Final Revision and edition	Miryam Navarro, Lluïsa Sort, & Gabriel Lemkow (FUB) Luisa Zecca & Valeria Cotza (UNIMIB)

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1. Executive summary

The following deliverable corresponds to the Protocol for the pilot interventions which will take place during the second year of the C4S project. This deliverable is led by WP4 (with the support and responsibility of all other partners) and contains a **piloting strategy and programme**, that explains the research questions, the timeline of actions to be undertaken, the conditions for the pilot setting, and the methodological procedures, with the description of the type of data to be collected and the data gathering tools. This deliverable is the results of the work undertaken within the Task 4.2 (Co-Creation of the Pilot and Protocol).

The pilot programme below introduces the guidelines on how to plan, design, and implement the pilot core activities, by summarising and clarifying the components stated above. It includes also the training activities for educators, the type of activities to be undertaken and information about the Ethical Committee approvals.

GLOSSARY *(alphabetical)*

COMMUNITY IN VULNERABILITY RISK SITUATION: In different social contexts particular social groups may be more susceptible to certain types of risk such as social exclusion or segregation, become invisible in certain contexts, their demands and needs being unheard by the majority of population, etc. Some current communities in vulnerability risk situation are migrants or refugees, persons with physical or mental disability or members of the Roma community, amongst others.

COMMUNITY LIVING LAB (CLL): A Community Living Lab is a site (interior or exterior) open to the local communities and to the social and natural environment, whereby children and youth do research and investigate towards common goals and initiatives. CLL's may progressively evolve and incorporate new materials, tools, sites or social actors depending on the interests and initiatives of the participants

HUB: a Hub is each of the local nodes that interlink a diversity of institutions, social actors, CLL's and other resources to promote actions oriented towards inclusive science education activities or initiatives.

INCLUSIVE SCIENCE EDUCATION (ISE): Science is very relevant in our current societies and provides for new solutions, explanations, technologies and social needs. However, as a social practice, science (i.e., Science institutions, scientists, science education activities, scientific research, etc.) often reproduces or incorporates social values from the society/ies it is circumscribed in (e.g., sexism, racism, colonialism, capacitism/ableism, etc.). In this sense scientific products, pedagogical initiatives, institutional dynamics or classes (amongst other possibilities) at times end up reproducing values external to it (sexist practices or other discriminatory practices towards certain communities, invisibilisation of certain social groups, etc.) that shouldn't be part of the scientific content or formal presentation. An inclusive science Education approach attempts, thus, to tackle such issues by actively promoting non-exclusionary practices in science and by detecting and providing advice on how to promote a science (and science education activities and initiatives) more inclusive for and with all communities.

PILOT ACTIVITIES: These refer to the activities taking place in/through the CLL's during the data gathering process (Pilot period). The gathering of observations/data for further analysis during this pilot activities period (data gathering) doesn't preclude promoting previous activities in the CLL's to test the validity of the materials, engage children with their interests in the CLL's etc.

PILOT SITE: For the Data Gathering process (see above) each Hub should choose at least 1 CLL as a pilot site for data gathering and observation. Events observed may take place inside or outside the CLL premises (excursions, study visits…). Other local CLL's might nevertheless participating in Hub activities without the need to gather data for research.

RRI (RESPONSIBLE RESEARCH AND INNOVATION): RRI is an approach that anticipates and assesses potential implications and societal expectations with regard to research and innovation, with the aim to foster the design of inclusive and sustainable research and innovation. The main RRI deimnsions that arise in our research are the following: governance, ethics, gender, public engagement, open access and science education. Throught the WP2 tasks, the RRI approach will be supervised during the whole research process.

STEAM: This notion makes reference to the areas of Sciences, Technology, Engineering, Art and Maths, and often this term is used when these areas of knowledge are presented or conducted from an interdisciplinary approach with activities crossing the boundaries between these disciplines (i.e., by including and mixing / fusing two or more of these areas together).

2. Introduction and aims

Science education is a vital tool to allow children having a better knowledge of the realities they live and interact with. To involve society in discussing how science and technology may help us create the world we want and addressing societal challenges, C4S is open to the participation of all relevant social actors at all levels and aligns with societal values, needs and expectations. It is essential to detect the barriers that prevent access to science education for people from communities at risk of vulnerability and to reflect together on the exclusionary practices in scientific knowledge. However, these exclusionary practices in science – which could inadvertently convey or involve sexist, racist, body-normative, and socially discriminatory messages, amongst others – may also inadvertently occur in science and they will continue to occur, unless an inclusive approach is adopted as an essential starting point for both Science Education and Citizen Science activities. For this reason, the C4S project explores the relationships between Science and Society by focusing on some communities in vulnerability conditions, as active social agents or as members of the science community, especially given the fact that they, as scientists or specialists, are often not visible enough and that also encounter barriers that make their accessibility deficient in the science fields, struggling to achieve equal conditions in scientific activities and within institutions.

The C4S project is aimed at working with and for communities in vulnerability risk conditions by promoting science education to children and young people aged 0-16 years old (and to their families and surrounding communities), through formal and non-formal pedagogical institutions, involving political and cultural institutions and policy-makers. The project intends also to make visible and support scientists and educators from these communities, in order to provide a

diversity of role models in science in STEAM perspective to children, families, teachers, and educators.

The C4S project is developed through the creation of different local **hubs** in some of the participant countries. These Hubs are led by local partners who create networks of institutional and non-institutional supporters, social actors, schools/nurseries, and local activists with the aim to promote inclusive science activities and also the creation of local **Community Living Labs (CLL)**. In D3.2 a list of the members and the description of the 6 Hubs was presented.

The distribution of the target groups per Hub (which will be the main focus of actions) will include, at least one of these communities in vulnerability risk situation:

- **Immigrant (and refugees) communities**: Manresa-Vic Hub, Vienna Hub, Brussels Hub.
- **Persons with disabilities and/or Special Educational Needs (SEN)**: Milano Hub.
- **Roma community**: Budapest Hub, Sofia Hub.

Following the RRI approach, all the hubs will also take into account a Gender intersectional perspective in order to tackle issues of gender inequalities and gender rights as well.

For the research to be undertaken during 2022 *at least* one Community Living Lab *per Hub* will be chosen to obtain reliable information and data on the CLL pilot interventions about its development and implemented activities and results.

During the pilot interventions, the research will gather data from:

- **Children and young people aged 0-16 years old**
- **Families**
- **Teachers and educator generally**
- **Policy-makers and stakeholders**

The research will be done through a **qualitative research methodology** based on **multiple case studies**, whereby researchers will be gathering information from the different CLL experiences developed as **participant observers** and by means of a number of **common validated tools that will be triangulated** to allow an **in-depth analysis using similar criteria** in all cases (while also tackling the differences of contexts and realities in each study case).

This CLL pilots aim to gather a number of strategies and recommendations to allow their transferability to other EU contexts and groups in vulnerability risk situation.

More specifically:

The pilot process that will take place in/through community living labs (CLL) to provide for:

1. Designing and developing **inclusive science activities** and the promotion of events with different inclusive science (or science-related) interventions.
2. **Monitoring** the processes within the Living Labs (description and impact of activities undertaken, interactions occurring, continuity and evolution of processes, etc.) and get relevant data, in order to analyse the activities and actions undertaken in/with the Community Living Labs and discuss the results within a limited time-framework.
3. **Validating the potential transferability** and up-scaling of the activities to communities in vulnerability risk situations in other EU realities and/or Countries (and or other communities in vulnerability risk situation).

Through the findings of both the research interventions and the science education activities with social actors and experts (also from communities themselves), this project intends to provide data and recommendations on:

1. **How to create and boost research communities with children and their social environments that could be inclusive and have a real impact upon their daily realities.**
2. **How to detect and overcome barriers to inclusiveness** by developing strategies and tools and establishing strategic alliances with territorial networks and social actors at all social levels.
3. **Finding strategies to promote engagement and participation** of involved communities and other relevant social actors in current and future social, cultural, and political events and activities.
4. **Tackle and break with the severe asymmetries** in the abilities of individuals to interact with and access science concepts and activities.
5. **Make the positive role of communities visible** and boost social acknowledgment and recognition of their positive role by other local actors.

3. Research questions

The pilot activities will be undertaken with the **aim of gathering useful information to transfer** similar inclusive science activities to other EU realities and/or Countries. For this reason, some **general research questions** (GQ) and **Specific Questions** (SQ) will be used as point of departure to guide the whole process:

GQ1. How is it possible to **co-create** and boost the community living labs (CLL), with the children's and youth leadership, connecting with the **surrounding communities** needs and participation?

SQ.1.1 What **degree and type of co-participation** the CLL allow ?

SQ1.2 What are the **lived experiences** of both participants and co-researchers(and maybe stakeholders) during the CLL activities?

SQ.1.3 What **type of activities**, topics, initiatives and practical strategies take place in the CLL?

GQ.2 How the CLL's would allow the development, promotion and implementation of an **inclusive science education approach** through co-creation and co-research initiatives between together with children and families?

SQ.2.1 How to identify and **overcome barriers** to **implement inclusiveness** in science education, focusing on the target communities in vulnerability risk conditions? To what degree these communities or groups are affected by these barriers and how can these barriers be dismantled?

S.Q.2.2 What **factors, external or internal** to the CLL contexts**, facilitate or hinder inclusion in science education** activities with and for communities in vulnerability risk conditions?

G.Q.3 What is the short-term **impact** of the CLL upon the social environment of the Hubs (families, communities, city life, etc.)?

SQ3.1 What is the **material, relational and psycho-affective impact** of the inclusive science education activities in children, educators, families, and communities involved?

SQ3.2 What are the **factors that stood out** the most in each research context? Which of these **aspects are common to the different research contexts**?

S.Q.3.3 What is the **perception** by participants of the **impact** regarding the activities undertaken?

G.Q.4 What is the **potential social transferece** to other realities of the pilot activities results?

At the beginning of its pilot intervention, each Hub may want to consider more specific questions (maximum 1 per GQ) taking into consideration the different realities and needs of each Hub.

3.1. SMART and SPICED indicators

In order to properly answer the research questions, some indicators are described with the purpose to measure the impact of the activities and evaluate if the expectations of the participants were met. Both General Questions (G.Q.) and Specific Questions (S.Q.) will be developed thus leading to activities with **SMART** (**S**pecific, **M**easurable, **A**chievable, **R**ealistic and **T**imebound) impact (European Commission, 2017). Furthermore, this **impact study** will make available important information and results in the light of which to better analyze and interpret the qualitative data gathered.

These **SMART indicators** will be used in accordance with the H2020 principles and following also the Sustainable Development Goals (see Grant Agreement). Specifically, these indicators are:

Table 1 Pilot SMART Indicators

General Questions	Specific Questions	SMART indicators related to questions	Detailed Measure
GQ1. How is it possible to **co-create** and boost the community living labs (CLL), with the children's and youth leadership, connecting with the **surrounding communities** needs and participation?	SQ.1.1 What **degree and type of co-participation** the CLL allow ?	- Level of parents' and families' participation - Citizen participation by members of communities	- Proportion of parents and families involved in processes - Number of initiative and type undertaken with the involvement of citizens
	SQ1.2 What are the **lived experiences** of both participants and co-researchers (and maybe stakeholders) during the CLL activities?	- Satisfaction with activities - Interest in the activities undertaken	- Degree of satisfaction of the participants - Degree of interest (Likert scale)
	SQ.1.3 What **type of activities**, topics, initiatives and practical strategies take place in the CLL?	- Science and inclusion activities - Implementation of innovative methodology tools for inclusive science teaching	- Number and type* of inclusive and science activities - Number and type of innovative stragegies
GQ.2 How the CLL's would allow the development, promotion and implementation of an **inclusive science education approach** through co-creation and co-research initiatives between together with children and families?	SQ.2.1 How to identify and **overcome barriers** to **implement inclusiveness** in science education, focusing on the target communities in vulnerability risk conditions? To what degree these communities or groups are affected by these barriers and how can these barriers be dismantled?	- Activities related with identification of barriers - Type of barriers (physical, invisible, adminitrative) - Initiatives to detect and overcome barriers	- Number and type barriers (physical, invisible, adminitrative) - Number and type of CLL activities to detect and overcome barriers
	S.Q.2.2 What **factors, external or internal** to the CLL contexts, **facilitate or hinder inclusion in science education** activities with and for communities in vulnerability risk conditions?	- Risks and resources of the community, institution and urban design - Internal and external awareness about factors	- Number of activities with institution-representatives and/or policy makers to address issues of inclusive science education - Number of new territorial networks with stakeholders with a planning function for school policies

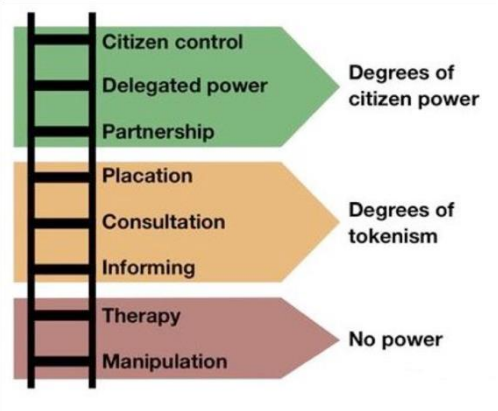
G.Q.3 What is the short-term impact of the CLL upon the social environment of the Hubs (families, communities, city life, etc.)?	SQ3.1 What is the **material, relational and psycho-affective impact** of the inclusive science education activities in children, educators, families, and communities involved?	- Changes/proposals of environmental improvement - Communicative and social and soft skills	- Number and type of changes/improvements in the environment - Number and type of transference prcesses to the community through products and spread activites
	SQ3.2 What are the **factors that stood out** the most in each research context? Which of these **aspects are common to the different research contexts**?	- Local environment factors - Factors of the centers involved	- Number and type of factors in each CLL - Number of factors in common between different CLL - Number of institutional and/or political changes
	S.Q.3.3 What is the **perception** by participants of the **impact** regarding the activities undertaken?	- Individual and collective change perception - Social utility of the project results from the viewpoint of participants	- Degree of satisfaction of the people engaged in the project - Likers to measure individual and collective changes perception
G.Q.4 What is the potential social transferece to other realities of the pilot activities results?		Potential transference of the results	- Number of people reached outside the CLL - Number of new contacts with other realities beyond the target groups

*Type: Neighbourhood, involving target communities, specialists, social actors involved,…

Also, following the RRI Public Engagement approach, and in order to monitor the ongoing process and understand if the expectations of participations are being met, the project will make also use of **SPICED** (**S**ubjective, **P**articipatory, **I**nterpreted and communicable, **C**ross-checked e compared, **E**mpowering, **D**iverse and disaggregated) **indicators** (Roche, 1999), which allow to have a better understanding of what it means to do successful science education activities. Compared to the SMART approach, the SPICED indicators resort to a bottom-up participatory approach, that requires a big involvement of community members: these indicators, indeed, will be **co-designed** at the first steps of the pilot by researchers together with the participants from the CLL.

For example, the co-design of the SPICED indicators may aim to monitor how the composition of children groups changes and evolves over time, what is the degree and quality of exchanges and meetings between practitioners, or what impact the degree of participation have. In this regard, it may be useful to always monitor the participation levels of those who are involved in the Pilot and keep track of it, using as point of departure the **Ladder of Citizen Participation** designed by **Arnstein** (1969), which provides for 8 degrees of different participation types:

Figure 1 Ladder of Citizen Participation



So, in order to monitor over time, the participation levels of those involved in the Pilot and in the networks around the Living Labs, the project aims to involve both researchers and participants in co-designing indicators based to both the SPICED approach and the ladder of participation.

4. Roadmap for the Pilot Programme

Following the **C4S Work Plan**, the development of the pilot activities is included in **Task 4.3** (Pilot activities development, implementation and data gathering), that will last from M13 (oct-22) to M24 (sep-23). The project milestone of this task is MS6 (Completion of the Pilots) and has to be achieved by September 2022. Additionally, **Task 4.4** (Data evaluation, analysis, and transferability) is also described in the present document, which its main document is the deliverable **D4.3** with the Final Pilot analysis Report (**M36**).

To make all the project plan and steps achievable, and in order to develop in a common way all actions and activities, this programme distinguishes **three different stages**, each of which corresponds to a time interval of the school year. The core of the piloting strategy and programme is the implementation of science education activities within the CLL's, to be carried out according

to a specific methodological procedure that will be explained below (see § 6). So, each partner is invited to pursue the outline of the following **roadmap**, which divided the entire pilot process into three different moments:

Figure 2 Roadmap for the Pilot Programme

Before the Pilot (October-December 2021), partners are required to:

- **Contact and/or start developing the Community Living Lab structure/settings/social actors**, selecting the Living Lab sites (by following the given criteria: see § 5.1) and designing the pilot interventions according to common criteria (see § 5.3).
- Set up the main commitment among actors.
- Organizing a **Training Programme for educators** in view of the implementation of activities (see § 5.4).
- Achieve the **Ethical Committee approval** (see § 5.5).

During the Pilot (January-June 2022), partners are required to:

- Fulfil and implement the **pilot activities** according to a specific common set of technical **research tools and approach** for all Hubs (see § 6).
- Plan periodical **assessment meetings with participants of the pilot (follow-up of activities, solving questions, provide practical assessment, connect with networks, provide extra-training topics…)**.

After the Pilot (from July 2022), partners are required to:

- **Analyse the data** and then **discuss the results** (see § 7), also providing meetings to give back the findings to participants
- Assess the impact of the pilot interventions, especially in order to evaluate useful criteria and strategies to promote their **potential transferability** to other EU contexts.

Figure 3 Pilot Developement GANTT Chart

			oct-21	nov-21	des-21	jan-22	feb-22	mar-22	apr-22	may-22	jun-22	jul-22	aug-22	sep-22	oct-22 to sep-23
T4.3	Before the Pilot	Analize Hub &choose CLL													
		EthCom Preparation & submission													
		EthCom Approval													
		Trainig Programme													
		Co-design Pilot activities													
	During the Pilot	Implement the pilot													
T4.4	After the Pilot	Data analysis													

Given that this research will take place in highly sensitive areas and amid a health crisis (i.e., COVID19) especially affecting communities in vulnerability risk situation, extraneous and unexpected circumstances may occur leading to the modification of some of the planned activities. In this case decisions will be taken with the consensus of the C4S members and following the advice, if required, from members of the Board of Advisors.

4.1. Pilot governance and functions

Given that the research will take place in different Hubs and will gather data in different contexts and realities involved in particular dynamics, a **pilot governance structure** will be devised to ensure that all pilot interventions and data gathering processes follow the expected procedures and functioning.

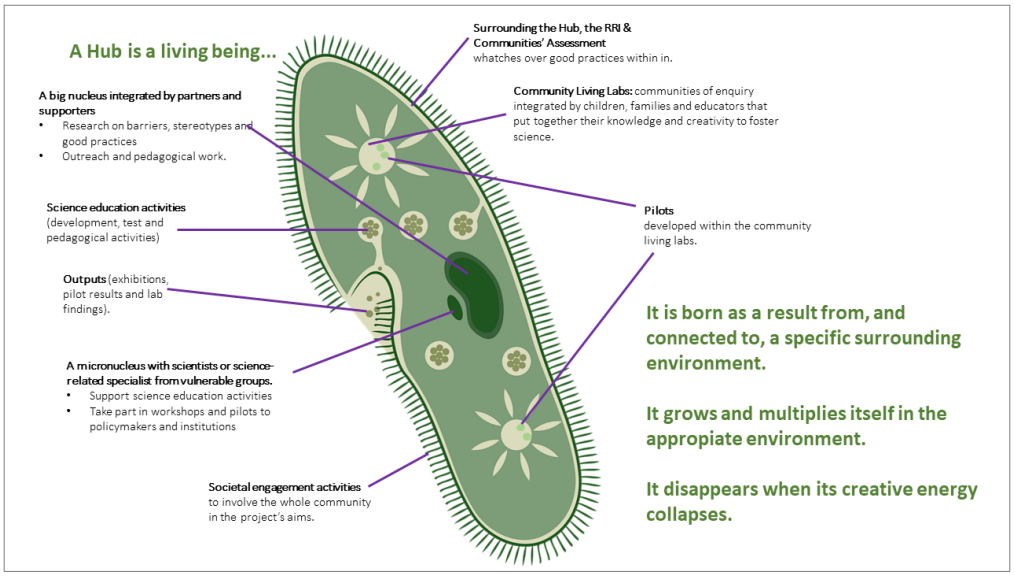
In order to do this, **one person representative per Hub** will be assigned the role of **Pilot Liaison** to communicate and attend to the specific meetings devised to coordinate the pilot activities in the CLL's and the research processes involved.

The **C4S pilot follow-up sessions** will be established periodically and the liaisons will have to report the activities undertaken and consult any queries related in this forum. The coordinators of these Pilot-Liaisons meetings will be **coordinated by WP4 leader (UNIMIB)** which is responsible for the Pilot interventions.

5. Before the Pilot: Preparing the pilot settings

During the 1st year of the C4S project the Hubs were developed and fostered under the guidance of WP3 leader by establishing strategic alliances with relevant social actors, members of the target communities, contacting and or boosting the CLL structure and organizing some activities aimed at training teachers, educators, practitioners, etc., i.e. the trainers themselves. The following image is a representation of the Hub structure, functions and actors

Figure 4 Structure of a Hub: functions and actors



Within each Hub, a number of CLL's are set up to promote the children's STEAM and inclusive activities. Before the pilot takes place, a minimum of one CLL per Hub will be chosen which fits best the following inclusion criteria

The C4S has 6 Hubs and hence there will be a minimum of 6 pilot CLL initiatives being monitored during the second year of the project

5.1. Criteria for selecting pilot CLL'S Pilot Sites

In order to proceed with the pilot interventions, each Hub will select a minimum of 1 CLL per Hub. The CLL (or CLL's) selected in each Hub will be chose following the above criteria:

Minimum and maximum length of time of commitment	From 2 up to 6 months (from January 2022)
Minimum number of participants (children and young people aged 0-16)	From 6 up to 30 participants (with *at least* one of the involved target communities of the Hub)
Educators/teachers	Full engagement in Training Programme Commitment in regularity of activities and assessments Commitment in data gathering Transformational interests
Policy-makers/institution representatives	At least, one representative connected with the CLL pilot site.

The research undertaken should **observe and analyze the ongoing process undertaken with the CLL pilots (and provide practical/technical assessment when required)**, thus conducting an in-depth study of the pilot processes occurring.

5.2. Contact and/or develop and boost the CLL structure

The research involves pilot sites of Community Living Labs, which are conceived as environments that promote research, experimentation, and co-creation of ideas and/or materials for the common interest and with the aim of leading to societal engagement. They take inspiration from the **Laboratory approach**, which is based on the Experiential Learning Theory (ELT) and especially on the Problem Based Learning (PBL), i.e., the process whereby knowledge is created through the transformation of experiences. According to PBL, we shall design "allosteric" environments that advocate a non-direct transmission of knowledge in favor of an active learning by children and young people (together with educators and families), shaping a **common community of enquiry** which develops through time some specific research related to science fields.

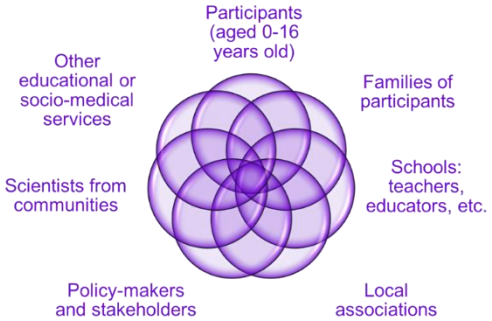
Peer knowledge and social interactions will be encouraged whereby children can learn through an exchange of ideas and comparison of hypotheses, solutions, explanations, etc. Furthermore, the **participation of other social actors** will be encouraged, especially from communities in vulnerability risk conditions and/or experts in science, as well as the involvement of local institutions. Therefore, the Community Living Labs take inspiration from an **eco-systemic and holistic vision**

As stated above, during this phase of structural implementation, partners are required to select their Living Labs (see § 5.1) and assume the common criteria to plan the pilot interventions (see § 5.3). At the end of this phase, by October 2021, each partner shall provide a **description of the Living Labs sites chosen**.

5.3. Common Criteria for Pilot Activities

The focus is not only on children and young people, but also on **the whole environment (see image below)**: the socio-cultural background of the Living Lab within which the activities take place must be in contact with the whole context around it.

Figure 5 CLL environment

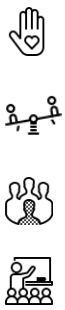


In the following Table are presented a number of cases which could exemplify the different social actors and pilot CLL initiatives to promote the Inclusive Science Education approaches through societal involvement as *Science With And For Society* approaches.

Table 2 Examples of Social actors involved and CLL pilot activities

	Children and youth		Families		Civil society / NGOs
	Members of vulnerable communities		Educators		Policy makers
	Scientists		Universities		Companies / Businessmen / Businesswomen

Social actors involved	EXAMPLES
	EXAMPLE/CASE: A civil institution working with children from migrant backgrounds is interested in promoting activities beyond what they usually do (homework, games). However, this civil institution lacks additional resources, has a limited number of educators and requires some support to start new initiatives with the children. C4S HUB INTERVENTION: The local C4S HUB, with the accompaniment of the Hub Researchers, suggests providing an initial training course to educators on Science didactics. The educators also agree in exchanging new ideas and also in visiting the science Lab area of the university to learn about new pedagogical possibilities. In order to engage the interest of the children with science enquiries, the educators, with the support of the Hub researchers, decide to organise a trip with the children so that they can discover their surrounding environment. On this day-out, the children look for samples of natural materials and once back in their centre, explore them with the new tools at their disposal.
	EXAMPLE/CASE: A group of children have been doing some Living Lab activities about famous women scientists. What should they do with the materials they have created so far for the finished project? Do the families have to take these materials away? C4S HUB INTERVENTION: The C4S HUB Researchers and implementers have been assessing the educators and children to learn how to make the children active science researchers. During these meetings they realise that the children have produced a lot of material, yet the most likely outcome that will happen is that these interesting materials produced by the children will be thrown away and forgotten without making visible their work done. The children decide by consensus to write to the Director of the local Public Library which has a big empty entrance hall to exhibit their works in the Gallery Hall of the Library building. They investigate about how to write an "official Letter" and how to organise a public display. The library agrees and co-organises with the children an exhibition on "Famous Women Scientists". The children also decide to write to Mrs Sharma who is a well-known scientist to explain her discoveries and area of specialisation in an open conference. The event is a great success, for the city and especially for the children.
	EXAMPLE/CASE: A group of school educators have detected an interest from their children in working on environmental issues. However, this time instead of using books, after some contacts with the local Hub, the educators want to make a more practical approach, but they feel they are not sure how to start. C4S HUB INTERVENTION: The C4S local researchers, in contact with the educators suggest that the children meet a Roma scientist specialised in types of soil and environmental

	actions. When the scientist visits the children, they show a lot of interest in how the area in the past was a big forest and decide to go one day to explore the remaining parts of the forest to learn more. They collect samples of soil, tree branches, seeds and leaves and take them to their school. Back in their school, with the Hub assessment, they discover more about what happens in a forest. At the end of the year, an exhibition is organised at the entrance of the Town Hall with some photographs of the discoveries and texts on the children's theories. The activity culminates with the re-planting of local trees with the help of families in the areas where there used to be a forest in the past.
	EXAMPLE/CASE: Recently there has been a museum exhibition in the city centre dedicated to issues concerning Technological machines for the advance of science. The exhibition is very successful; however, complaints have been made regarding the accessibility of people with specific needs/disabilities. C4S HUB INTERVENTION: although exhibition has already started the C4S research confirm these spatial barriers in the museum. It is agreed that the children's Community Living Lab will investigate the different types of barriers in collaboration with the museum and an institution that works with disabled people. They identify issues for wheelchair users, people with mobility problems, sight difficulties and other impairments. The children agree, as a result, to explain in a letter their findings to the museum curators and draft new information panels for persons with impairment or difficult access to the panels, to make the exhibition accessible for everyone. After this a training led by experts with a disability and support from the Hub, organise a training programme for the museum workers on accessibility.
	EXAMPLE/CASE: A university has shown interest in engaging children from their local community. There is an important number of Roma families that have been demanding improvements in their neighbourhoods. Furthermore the university is keen to approach future prospective students from different cultural backgrounds from the area in order to promote their studies to other collectives. C4S HUB INTERVENTION: The university also wants to create an area for the children from the local neighbourhood so that they can also come and participate in this public institution as users. The university teachers then work with their undergraduate students on how to create a useful and inclusive space. As a result, the university creates a small Community Living Lab with Low-tech materials (natural materials, modules about scientific phenomena, and children's books) and another with some High-tech tools for the families also to develop technological abilities useful for improving their future professional careers. The local families gradually start to visit the Labs also with their children. Undergraduate students frequently visit these labs, to exchange ideas with the families and to play with the children as part of their curricular programme. The students realise that since the families have begun to come to the Lab they have enlivened the university atmosphere and that they have even created informal networks to co-create local initiatives for the improvement of the neighbourhood.
	EXAMPLE/CASE: There is a local neighbourhood in which a Civil Society institution is working with children from the school areas. They intend to promote the interests of their children, but the area is very run down. The City Council also has recovery plans to improve the area for its local residents, but it requires other actions besides those designated by the local development plan. C4S HUB INTERVENTION: The educators contact the members of the C4S HUB and agree on looking for new opportunities to engage the children. The C4S members visit the children from this area and talk about what they like and what they do not like about the neighbourhood, who lives there and what shops and services there are in the area. The children decide to investigate around with a map of the area and cameras to take photos

	of the most interesting areas for them and to see what they discover. They meet various neighbours and shop owners from different backgrounds and, with the Hub support the children decide to interview Mr Moha, Mrs Sharma, Señor García and Mrs Leila Gonzales. Children learn from them about the history of the neighbourhood and the local river, about where the vegetables they sell come from, what minerals were extracted in the area in past times, etc. These interviews are uploaded in a virtual E-Map to explain to the past and present history of the local neighbourhood. With the mediation of the Hub members, the City Council becomes interested in the children's local initiative and decides to create a link on their institutional webpage
	EXAMPLE/CASE: There is a public exhibit on Art & Science that is currently being displayed at the main science museum of the city. It is very successful, but the local newspaper has criticised the fact that there is no mention of the role of female scientists and of some Eurocentric or racist components because it compares the scientific advances from a European country with the supposed "lack of technological advances of people living in Amazonia tribes. C4S HUB INTERVENTION: The exhibition has already However, the C4S researchers contact the Museum director and agree that they should revise some of the current practices on display and in order to complement the exhibition with a wider (and self-critical) view. As a result a number of talks will now be held during the exhibit by women scientists. Children also participate in one of the conferences to ask the scientists questions, and decide to write some texts and stories on what they would do if they were a scientist and inventors too to make a better world. The children also investigate on how could they make the exhibit inclusive and learn from other interesting female scientist from different backgrounds that could be included in the panels. The C4S HUB publishes the children's work and the scientists' interviews on their official institutional page and invites two scientists and two children to share their experiences in a videoblog.
	EXAMPLE/CASE: As every year, there is going to be another local fair for businesses on High-Tech and resources for the local policy-makers to invest in in order to create a smart city. Each year, the fair is open to big companies and some conferences are organised on new market trends regarding the use of technology. This fair is mainly addressed to investors, policy-makers and businessmen, not to the rest of the local community. C4S HUB INTERVENTION: The local C4S Hub realises that schools are never taken into consideration in these local fairs. As a result, during a visit to schools of these children, they talk to them about the Technology Fair and end up discussing robots and technological devices. The children get so excited about the conversation that the day after, they start creating and collecting their drawings on possible invented machines by them to travel to the future. During this process, the C4S Hub mediates with the local policy-makers in order to try to make these interests from the children visible during the Technology Fair and agree with them that a local stand in the Fair will show the children's projects. They also arrange for the radio to interview the children on the stand. Their exhibit is a success for their families and local citizens, and it is published on in their school Blog.
	EXAMPLE/CASE: There is a Civil Association working with people with disabilities and specific needs. They usually work with local families requiring support and having counselling. Once a year they receive the visit of Secondary School students to meet them and exchange ideas regarding people with disabilities, the realities of families, and some other leisure activities are organised in common between the children and the families. C4S HUB INTERVENTION: The C4S Hub is in contact with this institution and decides to meet with the families to hear from them if they have specific needs that Hub can give support to. During the conversations, the families explain that they feel they are being ignored by the local policy-makers who do not take into account their real needs. As a result, a

	proposal is put forward to create with the families and their children a small co-creative Living Lab in which they will, once or twice a week participate in a workshop activity to re-design different city areas (using scale models, google-maps and artistic or co-creative initiatives, etc.). During the yearly visit of the institution, the Secondary school students, impressed, decide to contact the City Council workers and representatives to make them aware of the work which has been carried out by the families, their children. It is agreed that a guided tour of the city organised by people with disability will be arranged to decide which areas are a priority to be improved. A photovoice exhibit, with the support of the undergraduate students, is organised with images of the walks around the city, and the drawings and reflective texts (about the walk) from children in the University Hall.
	EXAMPLE/CASE: Amira is a science student. She came from Morocco a few years ago and now she also works as a social activist. Although she regularly works at the university, she is not very connected with the activities of the city or with the local population, but she would like to be more involved in the local life and support those local initiatives of the city. C4S HUB INTERVENTION: As part of the project, C4S researchers have been looking for social actors from different communities. They have recently contacted Amira and asked her if she would like to meet the children and explain what her job in Geology entails and what her experiences as a female scientist are. Amira sets a day and meets the children. The children are very excited to learn from Amira's knowledge and experiences and make a proposal to start a research project on the Geology of the territory. Her participation works very well, and she accepts to be interviewed. The video is posted on Youtube for the C4S channel, and in this way, local schools can use her explanations uploaded on the internet to learn more about Geology, the role of female scientists, etc.

Some of these above examples show different possibilities that can be promoted by the C4S Hubs through the CLL's: fostering the contact between scientists (or science-related) specialists from vulnerable backgrounds and children, promoting new pedagogical scientific initiatives outside school, creating High and/or Low-tech Community Living Labs to encourage children in the field of science experimentation, engaging undergraduate students in the C4S Hub programmes with vulnerable communities as part of their curricular tasks, involving families in the co-creation processes to improve their local realities and to empower them, creating awareness in policy-makers on the need to attend to the needs of the local neighborhoods, making the cultural richness of the local neighborhood perceptible and promoting the voices of these social actors so that they are made visible as active agents of the city, etc.

The CLL pilot site should be an **alive** and **active** educational environment; it is not so much the number of workshops that take place within it that is important, but the fact that the site is kept open to research and citizenry and ensures a certain continuity in events and activities.

5.4. Training programme for educators

The educators, teachers and practitioners involved in the CLL pilot settings will participate in a training program before the beginning of the research data gathering with the main purpose to prepare them to develop and conduct CLL activities from an inclusive standpoint, providing thus criteria and strategies to educators so that they can become autonomous in carrying out the activities and become co-researchers within the project in accordance with the C4S values and pedagogical approach.

The training activities, aims at making each pilot CLL functional, and then will thus consist of **lessons, workshops or seminars** on STEAM or inclusion methodological approaches, research strategies, tools, etc. also to explain and clarify the data collection and analyses that will take place during the pilot activities of the CLL studied. During the actual pilot phase **follow-up and coaching meetings** will be planned, also inviting experts and/or scientists (maybe from the target communities themselves).

At least, ***a minimum of*** 2 sessions**, conducted by the C4S partners,** will be required for the pilot training programme containing the following (there is no maximum number of previous training sessions, as these will depend on the criteria of each Hub):

- Explanation of the **C4S** project outline, aims of the CLL, pilot intervention calendar and tools (this session should be undertaken by the C4S Hub partners responsible of the local research, and pointing to a figure of reference).
- **STEAM** contents, didactic strategies, examples of good practices, etc. to allow educators boost their knowledge on how to conduct CLL activities
- **Inclusive education** (and/or inclusive science education) criteria, strategies, pedagogical materials, good practices etc. to provide educators with a minimum criteria on what inclusive science education may involve and how it may be progressively implemented.

During the pilot interventions, C4S partners can also continue providing specific trainings on STEAM and inclusion issues during the assessment /follow-up sessions that will take place in the 2nd semester.

5.5. Ethical aspects

During the C4S pilot, the ethical issues that will arise will be related with Human beings and Personal data (following the H2020 GA nomenclature). In **D6.4** and **D6.2** are described how the C4S will overcome the issues related with the Ethical aspects, specifically with the procedures and criteria to identify and recruit participants and also with the technical and organizational measures that will be implemented to safeguard the rights and freedoms of the data subjects and research participants.

Taking into account **that C4S research will involve conducting activities with children and families from vulnerable backgrounds** (Roma community, immigration, or persons with disability), we will have special care in the identification and recruitment process of participants, avoiding any potential misuse of data or any labelling that would affect the dignity and reputation of the participants and their surrounding social or physical environments. To ensure that, a Board of Advisors is being created within the **WP2** and **WP1** tasks. The Board of Advisors will be constituted by experts specialised in the topics as well as by an Ethical Advisor, that has been assessing the C4S since the beginning of the protocol description.

The data collected during the research phase will be used only to reach the project's research objectives and to validate the activities to be transferred to other countries and realities beyond the C4S project. This **data will be managed by each partner institution following EU and national legislation** as well as its **own regular practices**, and always respecting the **right to privacy and withdrawal**. The results generated with this data will be presented in conferences and peer-

reviewed publications. This includes associated metadata. This data will be shared among partners only once the anonymization process is ensured and the rights of the participants for privacy are enforced and secured.

5.5.1. Ethical Committee approval

During October 2021, and before conducting the research activities, FUB, as project coordinator, will submit the research protocol to give the approval of the **Research Ethics Committee** at the University of Vic–Central University of Catalonia (UVic-UCC)[1], in representation for the whole consortium. It is expected to achieve the Ethical Committee's approval before by December. The protocol submitted to the Ethical Committee will be prepared to be valid for all the pilot sites. Nevertheless, the institutions that also would like or require to validate the protocol through its own ethical committee could do so.

Also, and during the Ethical Committee approval process, **all the partners involved in the research phase will sign the Letter of liability on Personal Data presented in the (D6.2)**, with the aim to guarantee the **independence and responsibility of each institution** in order to accomplish the technical and organizational measures to guarantee the protection of personal data and safeguard the rights and freedoms of the data subjects.

Once **the Ethical Committee approves the document, this document (that will include the tools and process of the research)** together with the liability letter of the partners, will be submitted as a WP6 deliverable (**D6.5**).

5.5.2. Information sheets and informed consents

Before starting the pilot activities, all the participants involved in each CLL pilot site shall give the **informed consent** after being informed of the procedures of the piloting with the information of the **information sheets**, that will also be delivered to all the participants, assuring a language and vocabulary intelligible to the participants.

When elaborate these documents, and to take into account the local languages so that the subject can understand the implications of the activity and, those Information Sheets involving children will be elaborated following the *Guidance note—Research on refugees, asylum seekers & migrants*[2].

The templates of the informed consent forms and information sheets will be elaborated during October and will also be submitted to the approval of the ethical committee together with the protocol. These templates will also be submitted as a WP6 deliverable (**D6.3**).

Given the nature of the project, that will involve educators (from the CLL sites) also actively working with the pilot, a Commitment Letter will be shared with all the educators involved in the pilot, and they have to signed before the beginning of the pilot activities. The Pilot Liaison (§ see 4.1) will be responsible to collect and safely store all the signed documents, for educators and also for participants.

[1] UVic-UCC Research Ethics Committee (link)

[2] Guidance - Ethics and data protection (EC) (link)

6. During the Pilot: Methodological approach

This research will consist in a **qualitative research** based upon a **multiple case study** whereby researchers will be **participant observers** of the pilot processes using a number of **shared tools** to gather and **triangulate information** among them to provide **in-depth analyses** of each CLL pilot process development and results/impact allowing to extract recommendations and strategies to transfer the CLL pilot activities to other EU realities and communities.

During the second year of the project, **each partner is required to develop, at least, one pilot activity per HUB**. As stated above, carrying out a pilot activity/intervention does not mean conducting only one scientific laboratory within the own Living Lab, but keeping alive and opening to the territory and the citizenry the Living Lab itself, involving first and foremost children and young people with their families in different activities, experiences, and events.

6.1. Multiple case study

The case study methodology (Stake, 1994; Yin, 2014) involves **in-depth data collection**, especially on representations and different viewpoints, structural characteristics, pedagogical approach and procedure, quality processes, and curricula. It allows to draw the interesting information specific to each study case, focusing on the **deeper meanings of phenomena** as required by the qualitative approach, whether inductive or deductive; moreover, it allows to explain, but especially to better understanding the phenomena observed, by cross-referencing different sources of data, to find the meaning given by the actors to their practices.

In particular, the C4S project has chosen to adopt a **multiple case study** (Stake, 2006), that consists of identifying phenomena and recurring patterns among a certain number of situations observed and analyzed. Thanks to the comparison of different constellations of characteristics, it promotes an analysis aimed at maximizing the **opportunities for triangulation**, by complementing different sources of information increasing the range of global understanding and analyses.

6.2. Relevant data to collect

During the C4S project development, a number of activities will take place that will involve the participation of children and their families from communities at risk of vulnerability, and there will be two ranges of observational data collected: data collected during the pilot development phase (WP4) and other kinds of data generated during science activities within the Hubs (WP3).

Data collected during the pilot development phase (WP4), will be used to reach the project's research objectives and to validate the activities to be transferred to other countries and realities beyond the C4S project. This data will also be presented in conferences and peer-reviewed publications. This includes associated metadata.

In the light of the research questions (§ 3) and the project as a whole, these emerge as the most relevant data to collect.

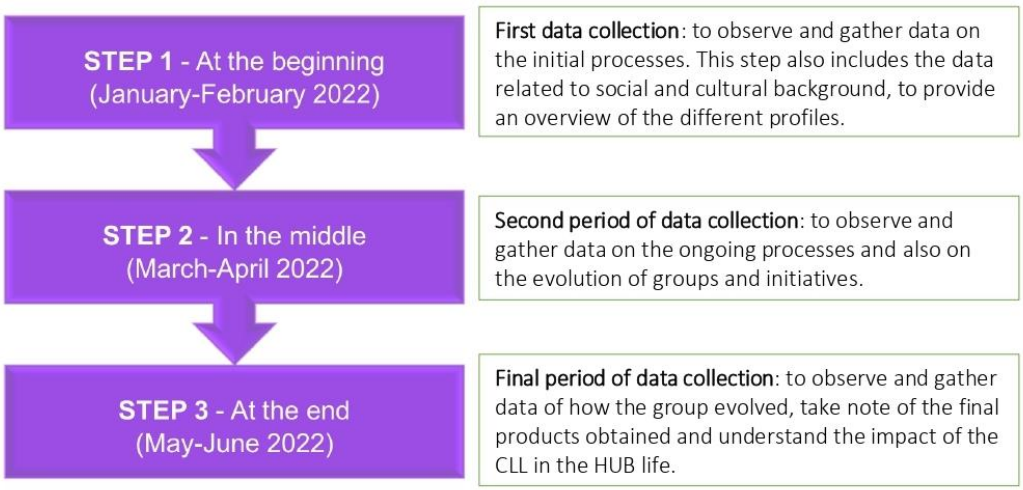
Table 3 Relevant data to collect

SOCIAL ACTORS TYPE OF DATA	CHILDREN & YOUNG PEOPLE	TEACHERS & EDUCATORS	FAMILIES	POLICY MAKERS & STAKEHOLDERS
CONTEXT	Sociodemographic information (if available)	Information about the centre (pedagogical project, urban context, evolution, classroom participation,…) & educator's relevant data	Sociodemographic information (if available)	City context, sociodemographic data, relevant policies implemented, social interventions,…
COMPETENCES	Evolution (pre/during/post) of : - Scientific competences - *Convivial* competences - Others relevant (cognitive-linguistic, motricity, socio-affective,…)	Evolution (pre/during/post) of : - Scientific competences - Didactic competences - Multicultural & inclusive competences	- Positive self-perception competences - Active participation competences	
LEARNING PROCESS /CONTENTS	- New STEAM knowledge - Products created - STEAM activities undertaken - New referents acquired from vulnerable communities - Awareness of social barriers & how to overcome them	- New science knowledge - New STEAM pedagogical strategies & methods - New inclusion & multicultural strategies - Outcomes of the activities - STEAM activities & initiatives undertaken - New referents contacted from vulnerable communities	- Families' perception on STEAM - Daily activities changes connected with STEAM approach	
SOCIAL INVOLVEMENT, PARTICIPATION & EMPOWERMENT	- Participation in mixed groups - Opportunities for participation and innovation - Degree of social interaction - New initiatives	- Promotion of autonomy & initiatives of children - Promotion of families' & communities participation - Coordination with other educators - Engagement with STEAM activities (internal and external to the centre) - Participation with network connections, local initiatives,…	- Participation in school activities - Networks with other parents or social actors - Participation in local & social initiatives - Willingness to learn from their children	- Initiatives to promote and visibilise activities by children/families/communities - Awareness and sensibility for STEAM & inclusive issues - Engagement with participants - Openness /participation/promotion in new local/institutional training activities (STEAM, Inclusion,…)
OUTCOMES & SATISFACTION	- Products created / material production - Communication of discoveries/research/activities undertaken - Degree of accomplishment of SPICED indicators	- Products created / material production - New pedagogical material available - Communication of discoveries/research/activities undertaken - Barriers overcome & inclusive outcomes - Degree of accomplishment of SPICED indicators - Satisfaction with trainings & assessment - Transference of knowledge to other areas/sectors/institutions/actors	- Documents generated - Meetings & debates - Degree of accomplishment of SPICED indicators	- Institutional participation - Documents generated - Visibility through institutional communication channels (SSNN, websites,…) - Degree of accomplishment of SPICED indicators

In order to analyze the evolution of the activity, the data collection will be occurring in **three stages:** at the beginning, in the middle, and towards the end of the pilot intervention.

During all steps, Hub researchers will keep track of the process through a **methodological process diary with structured or semi-structured sections**, which should help to organize the different activities and monitor the on-going processes, also in view of a possible remodeling of the intervention. At the end of the Pilot, these diaries will constitute an important pedagogical documentation for the analysis and interpretation of data.

Figure 6 Process stages



6.3. Data gathering tools

In line with the chosen methodological approach, mainly **common qualitative tools** to be used with the **same types of participants** are envisaged, although the use of some quantitative instruments is not excluded:

- Post- training questionnaire
- Interviews
- Transcriptions of activities & observation tool
- Educators and researchers diaries
- Focus groups
- Pedagogical documentation (photographs, school documents, teachers' diaries…)
- Pre-post Questionnaires

In addition to this common core/set of tools for all partners, Hubs can use extra particular tools (photovoice, drawings, narrative techniques, conversations by using toys,…) to gather extra information useful to engage their communities or obtain additional data.

Below are presented the tools corresponding to the different periods of the pilot and the persons responsible of gathering the data by means of these tools.

Figure 7 Tools to be used to gather data. Detailed for who gathers the data and period

<table>
<tr><td rowspan="2">Period</td><td colspan="4">Who gathers the data?</td></tr>
<tr><td colspan="2">C4S Researchers</td><td colspan="2">CLL Educators</td></tr>
<tr><td>Before the Pilot</td><td></td><td colspan="2">·Public sociodemographic data & information about urban context
·Information about school, classroom, educators... (public/available)</td><td>·Post-training questionnaire</td><td></td></tr>
<tr><td>1st Period (Beginning)</td><td rowspan="5">Researcher Diary</td><td>·Observational matrix (min.2 sessions)</td><td>·Pre-post self evaluation questionnaire</td><td rowspan="5">Educator Diary + Visual Doc</td></tr>
<tr><td colspan="2">co-create spiced indicators (children, families & educators)</td></tr>
<tr><td>2nd Period (Middle)</td><td>·Observational matrix (min.2 sessions)
·Interviews (educators & policy-makers)</td><td>·Participate in interviews</td></tr>
<tr><td colspan="2">monitor spiced indicators development (children, families & educators)</td></tr>
<tr><td>3rd Period (Final)</td><td>·Observational matrix (min.2 sessions)
·Focus groups with educators
·Focus group with CLL participants</td><td>·Pre-post self-evaluation questionnaire
·Participate in focus groups
Share all the documentation to the researcher</td></tr>
<tr><td colspan="2">impact & co-analysis of spiced & smart indicators</td></tr>
<tr><td>Post-Pilot Period</td><td></td><td colspan="2">Share processed & anonymised data with C4s partners for common data analysis / tools of multiple study cases</td><td></td><td></td></tr>
<tr><td colspan="4">global analysis of spiced & smart indicators</td></tr>
</table>

The above tools will be presented in more detail to the **Ethical Committee** for their approval and will be included in Deliverable **D6.5**.

7. After the Pilot: Data analysis

At the end of the pilot study, each Hub is required to enter the relevant and required data from **each pilot intervention**. A common system of data entry will be designed. Each report shall open with an **overview** of the specific case study, which provides a broad description of the research context and a **more detailed description** of the phases of data collection and other common relevant data. This initial overview is useful to highlight the structure and the key aspects of each CLL, in view of comparing the different cases and assessing the possible transferability of the interventions carried out.

Primary data will be collected as stated in the section 6 of this document. After that, the information will be shared **appropriately anonymised.** Then, the **data analysis** will follow. In the report the data shall be analysed according to the identified **indicators** and following a set of

theoretically based common categories, useful to start answering the research questions posed above together with the SMART indicators.

All the process and tratement of the data will follow the Data Management Plan (D5.2).

By using SMART indicators, C4S will have a tool that gives an overview of the whole project, together with SPICED indicators, with the aim to give recommendations for the possibilities of transberalibity of the project results.

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Related C4S Project Deliverables

D3.2 List of Hub members with descriptions

D5.2 Data Management Plan

D6.2 A description of the technical and organisational measures that will be implemented to safeguard the rights and freedoms of the data subjects/research participants.

D6.3 - Templates of the informed consent/assent forms and information sheets (in language and terms intelligible to the participants) must be submitted as a deliverable.

D6.4 – Requirement Nº 4 - Procedures and criteria that will be used to identify/recruit research participants, including children.

D6.5 - Copies of opinions/approvals by ethics committees and/or competent authorities for the research with humans must be submitted as a deliverable.