D3.1: Report of SSIBL implementation within CoP, and reflections on facilitation, support and implementation within each participating primary school - Round 1

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Deliverable Documentation Sheet

Title	D3.1: Report of SSIBL implementation within CoP, and reflections on facilitation, support and implementation within each participating primary school - Round 1
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Contents

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Glossary

Alma Löv	Alma Löv Museum of Unexp. Art
BBC	Beit Berl College
CM	Consortium Meeting
COSMOS	Creating Organizational Structures for Meaningful science education through Open Schooling for all
CoP	Community of Practice
CORPOS	Core ORganisational Structure for Promoting Open Schooling
HEI	Higher Education Institution
IE-UL	Instituto de Educação da Universidade de Lisboa
KdG	Karel De Grote Hogeschool katholieke hogeschool
KU	Karlstad University
MoE	Ministry of Education
SSI	Socio-Scientific Issue
SSIBL	Socio-Scientific Inquiry-Based Learning
SOTON	University of Southampton
STEM	Science Technology Engineering Mathematics
TPD	Teacher Professional Development
UU	Utrecht University
WP3	Work Package 3
WSC	Winchester Science Centre

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1. Overview of Deliverable 3.1

The aim of this deliverable is to describe the SSIBL-CoP implementations undertaken as part of Work Package 3 (WP3) during the first round 34 implementation of the COSMOS approach. Overall, during Round 1, WP3 partners have been able to successfully facilitate and support nine SSIBL-CoP implementations in collaboration with 42 teachers and approximately 400 children (aged 7-11 years old) across seven primary schools. Table 1.1 provides an overview of the SSIBL-CoP implementations that took place in each national context, and information on participants, topics covered and duration of implementations. Key messages from Table 1.1. are discussed below.

As can be seen on Table 1.1, the socio-scientific issues addressed varied depending on the schools', teachers' and pupils' interests and needs, addressing issues such as biodiversity loss, animal welfare and climate change in the UK, Israel and Portugal, and artificial intelligence in Sweden. The Communities of Practice (CoP) formulated to support and participate in teaching and learning about these SSIs through SSIBL consisted of a wide range of stakeholders from the school's communities such as school Headteachers, parents, school governors, as well as beyond the immediate school community, including researchers/scientists, representatives of National Agencies, informal science learning centres and educators. In total, more than 40 individual CoP members as well as collective groups (e.g. the Raanana park animal farm and kindergartens in Israel) were formed with support by the CORPOS teams formulated for each SSIBL-CoP implementation. This illustrates the strength of the COSMOS open schooling approach. In most of the seven participating primary schools the CORPOS consisted of the participating teachers and the HEI and societal partners of each national context. This allowed for strong professional relationships to be formulated which then facilitated further engagement and motivation from all participants.

The SSIBL-CoP implementations designed varied from 5 to 10 lessons on average, which is expected for a unit sequence, and the time allocated for delivering SSIBL-CoP implementations ranged from 10 to 24 hours depending on the number of CoP members involved, the time available to co-design as well as to implement these activities within normal school hours. An important success of these implementations is also the range and number of informal learning centres and stakeholders that were involved, beyond the societal partners (e.g., Hilliers Gardens in the UK, animal farm in Israel) which allows for strengthening the COSMOS open schooling approach implemented and taking teaching and learning within the community through science education initiatives.

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WP3 partners have conducted SSIBL-CoP implementations with primary schools during the first round of implementation in four of the five national contexts taking part in WP3 (UK, Sweden, Portugal, Israel). The fifth national context (Belgium) will be conducting primary school implementations during Round 2. Belgium partners had initially recruited one primary school during the initiation phase, but due to the school's changing priorities in the following few months, the school decided to withdraw from the project. Instead of proceeding with a rushed recruitment of another primary school at the starting stages of the first implementation round it was decided that Belgium partners would proceed with working with their recruited secondary schools during Round 1 and would work with primary schools during Round 2. This issue was discussed with all consortium partners during CM2. COSMOS partners agreed and supported the approach adopted by Belgium partners, who now have a primary school recruited and fully engaged already in preparation for Round 2.

In the following sections, a report compiled by each pair of Higher Education Institution (HEI) and societal partners in the four national contexts is presented. Each of these reports discusses the work completed during the initiation and Round 1 implementation phases of COSMOS. Each pair of partners, provides summaries of their SSIBL-CoP implementations in relevant tables, indicating the key SSI questions asked and the activities conducted for each of the three SSIBL dimensions (ASK, FIND OUT, ACT), and how CoP members were involved in these dimensions. This shows the range of areas addressed and the wealth of activities conducted with primary schools across national contexts. Within each national context's report, there is a particular focus on describing and reflecting on the facilitation, support and implementation process of SSIBL-CoP for each participating primary school. These reflections will serve as important feedback for the SSIBL-CoP implementations undertaken during Round 2 implementations, both for new and for continuing schools in each national context. The last section brings together the reflections and considerations for next steps by each pair of partners, identifying key successes of our approach, as well as some common challenges and ways of addressing them, that can inform our TPD workshops and our Round 2 SSIBL-CoP implementations and start formulating a way forward for our roadmaps to open schooling.

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Table 1.1. *Overview of SSIBL-CoP implementations at the Primary Education level during Round 1*

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
UK (SOTON, WSC)	1. Primary school SSIBL-CoP implementation with Year 2	Year 2 (6–7-year-olds)	2	45	- 2 Year 2 teachers (one was the primary school science coordinator) - 1 WSC Partner - 3 SOTON partners	- Headteacher - 3 parents with experience of working on conservation & biodiversity projects - 8 members from informal science learning site which children visited - 2 School Governors, who attended children's presentations and asked questions about their SSIBL work	Biodiversity loss & climate change	5 lessons (4.5 hours approx.) 1 school trip (5 hours) **Total:** 9.5 hours approx.
UK (SOTON, WSC)	2. Primary school SSIBL-CoP implementation with Year 3	Year 3 (7–8-year-olds)	2	57	- Year 2 teacher (primary school science coordinator) - Two Year 3 teachers - 1 WSC Partner - 3 SOTON partners	- Headteacher - SOTON University researcher from Biological Sciences department - 8 members from informal science learning site which children visited	Biodiversity loss & climate change	8 lessons (7.5 hours approx.) 1 school trip (5 hours) **Total:** 12.5 hours approx.

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
UK (SOTON, WSC)	3. Primary school SSIBL-CoP implementation with Year 5	Year 5 (9-10 year olds)	1	17	- 1 Year 5 teacher - 1 WSC Partner - 3 SOTON partners	- Headteacher - SOTON University Researcher from Biological Sciences department - 2 WSC members of staff who supported biodiversity related learning activities during the Year 5 school visit to WSC	Biodiversity loss & climate change	7 lessons (6 hours approx.) Observations of butterflies over time (1 hour approx.) 1 school trip to WSC (5 hours) **Total:** 12 hours approx.
SWEDEN (KU, Alma Lov)	4. Primary school SSIBL-CoP implementation with Year 5 & 6	Year 5 & & (11–12-year-olds)	6	123	- Year 5 & 6 teachers, in total 6 persons - 1 Alma Löv partner - 1 KU partner	- 1 staff member from Karlstad Makers holding an AI creative workshop with all pupils	Artificial Intelligence	10 lessons + one full day at KU (15 hours approx.)

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
PORTUGAL (UL-IE, Ciência Viva)	5. Primary school SSIBL-CoP implementation with School 1	Year 2 (6–7-year-olds)	1 (together with 2 teachers from secondary school)	24	- 1 Year 2 teacher - 2 teachers from secondary school - 1 Ciência Viva Partner - 3 IE-UL partners	This were the CoP members for all the school levels (in some school levels, only some of them participated): - One specialist from "Civil protection" - 1 pupil belonging to the fire department - 1 Portuguese Language teacher - 1 English Language teacher - 1 Family member with knowledge of Mandarin Language	How to live in a planet that shakes? Are we ready for an earthquake?	7 tasks (24 hours approx.)
PORTUGAL (UL-IE, Ciência Viva)	6. Primary school SSIBL-CoP implementation with School 2	Year 2 (6–7-year-olds)	1 (together with 2 teachers from secondary school)	24	- 1 Year 2 teacher - 2 teachers from secondary school - 1 Ciência Viva Partner - 3 IE-UL partners	- 1 entomologist from Ciência Viva - Microplastics experts from a Ciência Viva project - 1 Visual Education teacher - Plant experts from local municipality	Biodiversity loss	4 tasks (20 hours approx.)

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
ISRAEL (BBC, MOE)	7. Primary school SSIBL-CoP implementation with School 1	Year 4-6 (9-12 years old, working as one multi-aged group)	5	20	- School Headteacher - Science teacher designated as COSMOS coordinator - environmental education & educational trips coordinator - language coordinator for Years 3-4 - Year 2 homeroom teacher social education coordinator - 2 BBC partners - 1 MOE partner	- Teacher activist for the protection of street cats - 3 parents experienced in raising animals - Municipality Representative/Environmental Protection Unit - Kindergartens in the school's neighbourhood - Volunteers (parents) - Raanana park (municipality) animal farm - Department of Education of Raanana Municipality - Animal hospital in nearby town - 2 members from the Centre for the Protection of Wild Birds - Pupils	Animal Welfare (Protection of animals- domesticated and wildlife in urban environments)	10-12 hours of lessons and activities + 2 hours concluding event
ISRAEL (BBC, MOE)	8. Primary school SSIBL-CoP implementation with School 2	Year 4-5 (10-11 years)	5	50 (two 5th grade classes)	- Headteacher - Vice principal & science teacher	- 3 parents experienced in bee farming - Representative of the municipal environmental quality unit	Bee husbandry – human impact on bees/ loss of bees	17 hours total for all lessons and activities

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
					and COSMOS coordinator - Art teacher & social education coordinator - Science teacher – Years 1 & 2 coordinator - Ecology teacher and animal therapist Education - Representative of parent committee - Education desk in the regional EPA unit - 2 BBC partners - 1 MoE partner	- Bee expert volunteer		
ISRAEL (BBC, MOE)	9. Primary school SSIBL-CoP implementation with School 3	Years 5-6 (10-12 year old)	19	29 (16 5th graders, 13 6th graders)	- Headteacher - Pedagogical coordinator and science teacher	- Vice principal - 2 Physical education teachers - 3 parents with experience in promoting health in the community	Healthy lifestyles as my community challenge	5 lessons + concluding peak event

Country (COSMOS Partners)	School SSIBL-CoP Implementation	Year group (pupil age)	Num of teachers involved	Num of pupils involved	CORPOS members & role	CoP members & role (in addition to CORPOS)	Chosen SSIBL theme	Duration of Implementation
					- Science teacher and COSMOS project coordinator - Language teacher and part of school management team - Medical Doctor/public speaker and head of local medical centre - 2 BBC partners - 1 MOE partner	- several grandmothers (healthy food and medicine- traditional approaches) - Dietician (diet plan with a group of pupils) - Medical Doctor (gave lectures & workshops)		
Total	9 SSIBL-CoP implementations	Year 2-6 (7-12 years olds)	42	379	Approximately 45 i mainly within school stakeholders (teachers, headteachers) and outside school stakeholders	at least 48 members and several groups	Biodiversity loss; bee husbandry; animal welfare; earthquake preparedness and resilience; healthy lifestyles; artificial intelligence	10-24 hours approximately

2. United Kingdom Report (Partners 2 & 9, SOTON/WSC)

2.1. SSIBL-CoP Implementations in a UK primary school

During Round 1 of the COSMOS project, we have worked with one primary school to develop and implement three SSIBL-CoP implementations with 5 science teachers and approximately 100 primary school pupils (7-10 year olds). The networking, CPD and collaboration meetings that took place with the school as part of establishing and maintaining CORPOS, and identifying the SSI in focus are discussed in this section. We then report separately on the formation of the three CoP and on each of the three SSIBL-CoP implementations that were conducted in this school.

Within WP3, we have worked with one primary school in developing SSIBL-CoP implementations. We initiated this work with the intention to work across all six year groups, but due to reasons such as teachers' time commitment, absence and other unforeseen circumstances, we were able to work with three of the six year groups (Year 2, Year 3, Year 5) in order to co-design and implement SSIBL-CoP implementations.

The CORPOS at this school was initiated by the school's science coordinator (one of our Year 2 participating teachers). The science coordinator is responsible for overseeing the science curriculum across all year groups within a school, and supporting other teachers with science teaching and learning. This teacher was new to the science coordinator role at this school and wanted to collaborate with Southampton Education School in identifying approaches to teaching primary science that could enhance the school's science curriculum, particularly outdoors learning as the school had created an outdoor classroom and had a pond which was not used as part of learning activities. The SOTON partners had initial discussions with this teacher about the COSMOS project, and a recruitment meeting took place in April 2022 (COSMOS Initiation phase) during an all-staff meeting at the school to discuss the project objectives. Both SOTON and WSC partners attended another all-staff meeting to conduct the school openness focus group discussion (5th October 2022) based on the school openness evaluation tool provided by Work Package 7. After this process, we started working with the teachers for the TPD workshops and networking in preparation for the co-design of our SSIBL-CoP implementations.

Most teachers attended our first TPD workshop (31st October 2022), which focused on SSIBL. We introduced SSIs and inquiry-based learning, and then discussed with the teachers local issues they

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would like to explore by doing a walk around the school grounds. Two issues were identified; the first was a recent cut down of trees near the school's boarder with local houses, after residents complained about them. The second issue was the cost-of-living crisis and whether the school should be focusing on growing their own food to address this issue. Another topic discussed was the under-used and under-developed pond that the school had, which was fenced, and was not used by the children nor the teachers. We used a mapping document from WP5 guidelines to explore these two issues and identify potential CoP members, as showing in Figure 1.

Identifying SSI and mapping them to your curriculum– Last time

Suggested socioscientific issue	Reasons for selecting this issue	Connections to school's science curriculum	Community member/s & their role regarding the issue
Trees cut down Loss of biodiversity	Happened at school, children loved playing in that area	Plants, Living things, Working Scientifically, Habitats,	New Forest Trust? Neighbours School leadership Romsey Council
Cost of living crisis Should we be growing our own food?	Topical, affects many children in school	Plants, Living things, Working Scientifically, Light Seasonal changes	Food banks Parents Hilliers Garden Centres STEM Ambassadors

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***Figure 1**: Completed template from WP5 guidelines on identifying SSIs and CoP members and linking to the curriculum*

The second CPD workshop focused on community engagement and was combined with the co-design process. This took place separately with each of the groups of teachers that wanted to continue to be involved (Year 2, Year 3, Year 5, Year 6) from December 2022 until January 2023 (we were not able to continue working with the Year 6 teacher due to time commitments and national exams). During these separate Year group workshops, we finalised the SSI in focus (biodiversity loss) but with the pond as a theme rather than the cut down trees, as the teachers thought that the cut-down trees context would not be of interest to all children at that point in time. For each of the three year groups, we co-designed and implemented one SSIBL-CoP implementation. The CORPOS for each implementation was the same, consisting of the class teachers respectively, and all SOTON and WSC partners. The following sections comment on CoP formation and SSIBL-CoP implementations, which were different for each of the three year groups with which we collaborated, although some key

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commonalities existed; for example, the CoP members external to the school were the same for Year 3 and Year 5, but Year 2 had additional members included (e.g. parents and school governors).

SSIBL-CoP Implementation with Year 2: Should we keep the school pond?

The school's two Year 2 classes (approximately 45 children) and their two teachers took part in this SSIBL-CoP implementation. The CoP identified for this SSIBL-CoP implementation was linked to the various activities agreed during the co-design process. For example, one Year 2 parent was a conservationist and thus had relevant expertise they could share with the children, and were thus invited to talk with the children during Lesson 2 and to answer their questions about the pond. Overall, the work conducted with the two Year 2 classes at this primary school incorporated all three SSIBL dimensions with CoP members included in each dimension, as described next in Table 2.1.

Table 2.1. *SSIBL – CoP implementation with Year 2 in a UK primary school*

SSIBL dimension	Description	Duration
ASK	Key SSI question: Should we keep the school pond? The teacher introduced the lesson by reading to the children a letter from the Headteacher; the letter was explaining to the children that there were concerns about the safety of children at the school and the pond would be removed. In this way they were introduced to the key SSI question and then engaged in FIND Out activities to answer it.	Lesson 1 (50 min approx.)
FIND OUT	During the first lesson, the children were asked to think about their own opinion about whether they should keep the pond and why and listen to each other's views. They then co-created with the teacher a controversy map of all different perspectives on the issue, and identified who (e.g. scientists, school site manager, University) could help them answer the question (personal and social inquiry). These stakeholders then were approached and become the CoP members. Children formulated questions about the pond they would like to ask CoP members, who visited Lesson 2 and talked with the children (Headteacher, parent, site manager) Children visited a local outdoors learning centre (Sir Harold Hilliers Gardens) where they engaged in educational activities like pond dipping,	Lesson 1 Lesson 2 (50 min approx.) Lesson 3- Whole day (5 hours)

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	learning how to identify species found in the water, using simple classification keys, and using microscopes to observe them. Children conducted investigations to compare their school pond to the ponds they experienced at Hilliers Gardens Children went outside to identify and observe micro-habitats around the pond.	 Lesson 4 (50 min approx.) Lesson 5 (50 min approx.)
ACT	The children wrote a response letter to the Headteacher to say what they thought (keep or don't keep the pond) and why (e.g. the pond is important because it supports different species etc) (planned action) The children visited another school which has a pond but is not being used, to tell them about what they have learned and done at their school, what to give suggestions about how the new school should use their pond and why (i.e., to support and encourage wildlife within their school grounds). (planned action) Children created dioramas of the pond to visualise what they would like it to look like and then presented these to two school Governors, in order to explain to them why they thought they should keep the pond (completed action)	1 lesson Half day school visit Lesson 6 (50 min approx.)

During the co-design process, we had planned for the children to take actions such as write a response letter to the Headteacher in order to explain to them why they should keep the pond, and also to visit another school that had a pond they were not using, in order to advocate for why ponds are important for the environment and why they should be using them. These two actions were not completed (it was not possible to arrange another filed trip for all children to another school), but we include them in Table 2.1 to demonstrate the work conducted during the co-design process with teachers. Working with the two Year 2 teachers we adapted the planned actions and during Lesson 6, two school governors visited the Year 2 classes to hear what the children had learned and to discuss with the children why the school should keep the pond, thus also implementing successfully the ACT dimension into our SSIBL-CoP implementation.

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SSIBL-CoP Implementation with Year 3: How should we maintain the school pond?

The school's two Year 3 classes (57 children) and their teachers took part in this SSIBL-CoP implementation. The two participating Year 3 teachers worked with SOTON and WSC partners in order to co-design and implement the lessons described in Table 2.2 below. In addition, one of our SOTON partners was able to observe Lesson 1, and to observe and take part in supporting Lesson 2 (pond visit with Biology expert from University of Southampton) and Lesson 7 (creating bug hotels near the pond). All three dimensions of SSIBL were implemented and CoP members were incorporated in all three dimensions as described in Table 2.2.

Table 2.2. *SSIBL – CoP implementation with Year 3 in a UK primary school*

SSIBL dimension	Description	Duration
ASK	Key SSI question: How should we maintain the school's pond? The teachers introduced the lesson by showing children photos of the currently under-developed and overgrown school pond, and ask the key SSI question. Children learned what 'maintained' means, making links to Literacy lessons. They then came up with suggestions with which they could proceed, and identify what they should know and be able to do in order to proceed with interventions for enhancing and maintaining the pond, and its environment.	Lesson 1 (50 min approx.)
FIND OUT	During the first lesson, the children were asked to think about their own opinion about how to maintain the pond and why they thought this was important, and listened to each other's views. They then discussed what they need/should do to have a well-maintained pond at their school. Children formulated questions about the pond they would like to ask CoP members (University Biology lecturer, SOTON partners) University Biology researcher and SOTON partner visited the school and with the children observed the pond and its surroundings, discussing what is there and what they could to have a well-maintained pond. Children visited a local outdoors learning centre (Sir Harold Hilliers Gardens) where they engaged in educational activities like pond dipping, learning how to identify species found in the water, using simple classification keys, and using microscopes to observe them.	Lesson 1 Lesson 2 (50 min approx.) Lesson 3 - Whole day (5 hours)

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	Children conducted investigations to identify what living things are in and around the school pond using identification cards. They wrote re-counts of their field trip (curricular links to Literacy). Children discussed the benefits of a well-maintained pond and then identified interventions (bug hotels, planting wildflowers) to implement to enhance the pond environment and maintain it at a good level. Children learned about pollination and its role in supporting the environment in general as well as the habitats around the pond.	Lesson 4 (50 min approx.) Lesson 5 (50 min approx.) Lesson 6 (50 min approx.)
ACT	Children implemented biodiversity interventions they identified to enhance the school pond environment and have a well-maintained pond (they grew wildflower seeds and then planted them near the pond; they created bug hotels near the pond and placed their planted wildflowers near the bug hotels). Children made a leaflet/poster to tell Year 4s how to grow their own wildflowers, and why this is important for helping the pond and the environment.	Lesson 7 and Lesson 8 (50 min approx./lesson) Lesson 9 (50 min approx.)

SSIBL-CoP Implementation with Year 5: How can we make our school pond more biodiverse?

The school's Year 5 class (17 children) and their teacher took part in this SSIBL-CoP implementation. As with Year 3, the only external CoP member in this SSIBL-CoP implementation was the University of Southampton Biology researcher. The three dimensions of SSIBL were planned and implemented with CoP members incorporated in two of the three dimensions. The ACT dimension was not completed due to the teacher's high workload and other responsibilities which did not allow time for the newsletter items to be written and shared across the school community. The Year 5 SSIBL-CoP implementation is summarised in Table 2.3 below.

Table 2.3. *SSIBL – CoP implementation with Year 5 in a UK primary school*

SSIBL dimension	Description	Duration
ASK	Key SSI question: How can we make our school pond more biodiverse? The teacher introduced the lesson by introducing the concept of biodiversity to them and discussing it in relation to the school pond.	Lesson 1 & Lesson 2 (double lesson, approx. 2

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	Children watched a video explaining biodiversity and then discussed key questions (Why is biodiversity important for the environment? How can we improve biodiversity in our school?). Children were asked to think about their own opinion about biodiversity and how to make the school pond more biodiverse. They then worked in groups in producing controversy maps in order to explore in more detail the complexity of the issue of biodiversity loss in the context of their school grounds and pond. During this process, they identified questions they would like to raise and find out more about in relation to the socio-scientific issue of biodiversity loss.	hours on same day)
FIND OUT	The teacher provided children with a factsheet about biodiversity in the UK context (e.g., 41% of UK species have declined since the 1970s) and asked the children to annotate it with their comments. University Biology researcher and SOTON partner visited the school and with the children observed the pond and its surroundings, discussing what is there and what they could do to enhance the biodiversity at their school grounds and around the school pond. Children worked on identifying patterns in nature by researching local plants and animals (e.g. hedgehogs) using secondary sources (e.g., books, information given by the teacher) Children learned about lifecycles of local animals (frog, butterfly, bird, hedgehog) that they could have at and around the school bond in order to make the school pond more biodiverse. Children visited WSC where they engaged in educational activities to further explore and understand the concept of biodiversity (e.g. they observed and learn about moths and their role in local habitats, they learned through play-based learning about predators and food chains). Using a butterfly growing kit children made accurate observations during the different stages of a butterfly's metamorphosis (conducted over a number of weeks)	Lesson 1 Lesson 3 (50 min approx.) Lesson 4 (50 min approx.) Lesson 5 (50 min approx.) Lesson 6 - Whole day (5 hours) Approximately 1 hour

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ACT	Children identified and implemented biodiversity interventions to enhance the school pond environment (they grew wildflower seeds and planted them near the pond, they released the butterflies that hutched from their butterfly kit). Create items for the school newsletter in order to inform the school community about their learning, investigations and actions (planned action)	Lesson 7 (50 min approx.)

2.2. Reflections on facilitation, support and implementation within the participating primary school in the UK

Reflections on CORPOS work

Overall, and similarly to the work we have completed for WP4, the collaboration and professional relationship we have established between SOTON/WSC and the participating primary school as well between us (SOTON and WSC partners) has been a key strength and positive outcome of the work we have conducted during Round 1. The frequent communication with school teachers, by email, and our in-person workshops and meetings supported this process. All CORPOS meetings we had were in-person, which facilitated engagement and supported more in-depth discussion and exploration of issues. The use of an online platform (MS Teams) for sharing materials facilitated the co-design process as following our in-person meetings we were able to develop, review and adapt collaboratively with the teachers the teaching materials for the planned activities.

A key facilitator for the creation and establishment of the CORPOS at this primary school was the interest, motivation and commitment to the COSMOS approach that the school's science coordinator demonstrated, which acted as the lead contact person for the school and our SOTON/WSC team. This allowed for meetings to be arranged at times that were convenient for all CORPOS members, and time was given to understanding how the school works and how to best implement the COSMOS approach within the school's science curriculum.

Reflections of CoP work

The CoP formulated for each SSIBL-CoP implementation depended on the lesson sequence designed, each year group's learning needs and interests, as well as opportunities provided through the expertise of other stakeholders. For example, there were parents in the Year 2 classes who were

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knowledgeable of nature conservation and were able to act as stakeholders attending Lesson 2 and answering children's questions. School leadership was supportive of the COSMOS approach, and become members of the CoP formulated for two of the three year groups as needed according to the lesson sequences designed. For example, the Headteacher took part in our all-staff meetings at the start of the school year, and attended and supported the Year 2 and Year 3 field trip to Hilliers Gardens. Other CoP members, such as the University Biology researcher, who talked to all Year 3 and Year 5 children about the pond and how to improve it, were less involved in the CoP created for the Year 3 and Year 5 implementations. This was due to the lesson sequence and the time commitments both of the CoP members, and the SOTON/WSC partners; having to support and facilitate three separate CoPs that were active for most of the Implementation phase and beyond (March -July 2022) meant that we have to have small groups of people that were interested in this work and willing to support it.

Reflections on SSIBL-CoP implementations

A key success of our SSIBL-CoP implementations in collaboration with this primary school was the fact that a whole-school approach was agreed, and this was further facilitated by the use of a unifying theme (pond), which acted as a context for learning about the SSI chosen (biodiversity loss and climate change). Having a unifying theme for the three SSIBL-CoP implementations was also a key facilitator of supporting sustainability of the COSMOS approach within this school. Teachers worked together in creating a progression of SSI questions in order to allow children to engage productively with the SSI in focus. Younger children focused on whether the school should keep the pond, with older children in Year 3 thinking more about how to maintain (and improve) the pond, with Year 5 focusing more explicating on key scientific concepts such as biodiversity through their explorations by asking how to make the ponds more biodiverse. All the co-designing of lesson sequences and lesson plans that took place was using the schools' science planning documents, and as a result three schemes of work (sequences of SSIBL-CoP lessons) have been created that can be used by teachers in the following school years.

Another key success of the SSIBL-CoP implementations with this school was the fact that we were able to implement all three dimensions of the SSIBL framework (ASK, FIND OUT, ACT), and to integrate CoP engagement in these dimensions, during the planning and implementation stages. Even in cases where we were not able to complete planned actions due to time constraints and workload demands, we were able to adapt our planning in collaboration with the school teachers and to ensure that the ACT phase was implemented. The only case in which we were not able to incorporate community engagement in the ACT phase was with Year 5, who were not able to complete the newsletter communications that were planned.

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A key challenge we encountered in facilitating, supporting and implementing the COSMOS approach with three different year groups with this participating primary school was the associated workload. This was both in terms of the increased workload created in the SOTON/WSC team, as well as the lead teacher at the school, who was responsible for the day-to-day coordination of meetings, TPD workshops and field trips organized as part of our SSIBL-CoP implementations.

2.3. Lessons learned and next steps for Round 2 implementation

The key lessons learned from our Round 1 SSIBL-CoP implementations and next steps for Round 2 implementation are:

- The curriculum integration of the COSMOS approach to community engagement through science education is an area we will continue to work on in to further enhance the sustainability of the approach; we will do this with revisiting and further enhancing the schemes of work planned and implemented with the participating school, which has already agreed to continue working with us during Round 2. We will also take the same approach with any new participating primary schools that will work with us in Round 2.
- We will take a more focused curricular approach to working on SSIBL-CoP implementation during Round 2 with the same primary school, to ensure that challenges with managing workload can be dealt with more efficiently. We have already agreed to focus on Year 2 (new group of children) and Year 3 (same group of children as in Round 1) for the coming school year during Round 2.
- We will invest more time in networking earlier in the Round 2 implementation timeline in order to allow CoP members to be identified and more fully involved in the design as well as implementation of SSIBL-CoP activities.

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3. Sweden Report (Partners 4 & 11, KU/Alma Löv)

3.1. SSIBL-CoP Implementation in a Primary school in Sweden

A preliminary CORPOS team in the participating primary school was already existing since science teachers in Swedish schools always work in teams. KU and Alma Löv partners joined this science teacher team and formulated the CORPOS at this primary school. One of the teachers at the school was contacted directly by KU since this teacher has worked as a contact in previous projects. This teacher asked the colleagues and the Headteacher if the school was interested in joining COSMOS and they all were interested in doing so. Contacts were held with this "lead" teacher throughout the whole implementation via email contacts once a week during the implementation. TPD and planning visits were held at the school before implementation started with the pupils. In total there were three meetings before start working with the pupils. The TPD included training about the COSMOS approach (including SSIBL, not directly about CoP in terms of using the concept, rather talking about involvement of partners in society and benefits of collaboration). The teachers discussed between themselves what kind of SSI they wanted to work with, and they all agreed on working with the same SSI to strengthen their own CORPOS. Together they decided to focus on Artificial Intelligence (AI) since this started to be very much debated in the media at the beginning of 2022 with the release of ChatGPT. Hence, at the third meeting with the teachers the planning started.

The teachers themselves had ideas of what to do with their pupils and they wanted pupils to explore and find out how AI works and think about benefits and dangers of using AI. Together with KU and Alma Löv, it was planned that as part of the ASK stage in SSIBL the pupils would get a visit at Karlstad University for a full day. During this visit, pupils engaged in creative activities about AI with Alma Löv partners, took part in some practical activities working with some AI tools and had the opportunity to talk with someone involved in working with AI (a person from Karlstad Makers). At KU there is one researcher working with AI issues, however, for several reasons it was not possible to formulate a collaboration with school classes. Hence, Karlstad Makers was the best possible contact to include as a CoP partner. In total the school classes worked with AI during a couple of weeks consisting of about 10 lessons, each lesson lasting about 40 minutes and also a full day's activities at KU. The ASK part was decided by the teachers and presented to the pupils as: "Is AI something good or bad?" The teachers also made most of the planning of the FIND OUT stage, however, with freedom for the pupils to find answers using different resources on the internet.

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The CORPOS (the teachers, HEI and societal partner) and the CoP (CORPOS + Karlstad Makers) also together planned the FIND OUT day at KU. The teachers were thinking of having an exhibition of the pupils' creative work at the school, inviting all classes and parents to this event. However, since the project was going on at the end of the term (semester), there was no time to carry out this activity. All classes finalised the AI work with discussions (debates) in the classroom if they were for or against the use of AI in society with the pupils arguing for their opinions on this matter (ACT). Table 3.1 summarises the activities pupils took part for each of the SSIBL dimensions.

Table 3.1. *SSIBL – CoP implementation with a primary school in SwedenSSIBL*

SSIBL dimension	Description	Duration
ASK	Key SSI question: Is AI something good or bad? The teachers introduced the SSI by asking the pupils if they had heard about AI or Chat GPT before. The teachers also showed some video clips providing the pupils with information and different examples of AI and its use in society.	Lesson 1 (40min/lesson)
FIND OUT	Pupils were presented again with examples of AI and then asked to find out how this was included in different kind of digital tools they use themselves, such as Tiktok, Instagram, Netflix etc.. Pupils were asked to consider what kind of recommendations could the pupils identify in their own apps.	Lesson 2 (40min/lesson)
	Virtual assistance software such as Siri, Alexa, Google Assistant and Chat GPT were explored. Pupils had group discussions focusing on questions such as what kind of virtual assistance they use and what they think this could be useful for.	Lesson 3 (40min/lesson)
	Ethical aspects of AI. Self-driving cars and face recognition. Video examples and group discussions. What is an algorithm? Repetition for the pupils what an algorithm is and how it works? Followed by debate in small groups: • What do you think is good about the algorithms believing they know what you want to see? • Is there anything that could be bad about it?	Lesson 5 (40min/lesson)
	Practical activity in how algorithm works by sorting information. What is machine learning? How does it work?	Lesson 6 (40min/lesson)

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	Discussion again about different dilemmas, looking at some video examples. Testing ChatGPT Three activities – presentation again about what AI is, this time by staff from Karlstad Makers, workshop activity testing AI when combining two different AIs, ChatGPT and DallE to create stories, with the possibility for pupils to change pictures or the prompts in the story. Finally, a creative activity where the pupils in small groups were asked to create posters with the best AI they could think of, what would be possible.	Lesson 7 (40min/lesson) Lessons 8 & 9 (40min/lesson) One full day at KU
ACT	Decision making, final debates in the classes, with pupils arguing for or against AI.	Lesson 10 (40min/lesson)

3.2. Reflections on facilitation, support and implementation of SSIBL – CoP at this participating primary school in Sweden

In this section, we reflect on the ways we have facilitated, supported and worked together with CoP to implement the SSIBL-CoP activities with our participating primary school.

Reflections on CORPOS and CoP work

Overall, we found it easy to facilitate and support the creation of a CORPOS at this school since an initial form of CORPOS was already in place. However, it was a challenge to find partners to create CoP based on the chosen SSI. The region does not have companies involved in the development of AI and so it was challenging to find individuals within the school's/region's proximity with expertise in this field. We did not have any previous contacts and AI was a new issue for all of us, the CORPOS including the teachers, the HEI and societal partners. This is something we need to develop further if AI is chosen as an SSI in the second implementation round.

Reflections on SSIBL-CoP design & implementation

We were able to use the three dimensions of SSIBL during this SSIBL-CoP implementation. The activities were designed by the teachers and the full day at KU was co-planned by the CoP. It is

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difficult to see how the activities could have been better co-designed. Most of the problem being that the CoP in itself was limited and could have involved other and more partners. The school leadership was not directly involved in the process, only in the facilitation of the full day tour to KU for the school classes. The school classes were separated so not all classes did the same tour based on practical issues at KU. The teachers also did not want to have the Headteacher involved since they were having a conflict with the Headteacher based on other kinds of issues at the school. Even though the school leadership was not actively involved except for allowing the teachers to join the project and supporting changes in schedules etc. for the full day at KU, the overall experience and support by school leadership for the COSMOS approach was positive. Also, even though the CoP was limited, the work with SSIBL was considered as successful and appreciated by both teachers and pupils.

3.3. Lessons learned and next steps for Round 2 implementation

Development of CoP and collaboration with CORPOS should have more focus in the next implementation round.

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4. Portugal Report (Partners 5 & 10, IE-UL/Ciencia Viva)

In Portugal, during Round 1 we have worked with two school clusters. Schools in Portugal are organised in clusters: groups of schools from different phases of education that function under the same directive board and develop a common educational project they consider adequate for their social and cultural reality. For this reason, sometimes it is hard to individualise the work developed in each educational phase (primary or secondary) because participating primary and secondary schools in Portugal were working together in the development of COSMOS. For this reason, within Deliverable 3.1, as we present our work for SSIBL-CoP implementations at the primary school phase, you will also see references to secondary education members (e.g., teachers).

4.1. SSIBL-CoP Implementations in two primary schools in Portugal

SSIBL-CoP Implementation in School 1

The schools and some of the teachers involved in this process are special because they are used to implementing activism initiatives based on an inquiry-based science approach. Several of the teachers hold masters and/or PhD degrees from our institute (supervised by Pedro Reis) on the topic of pupils' activism (understood as a collective and democratic problem-solving process centred on socio-scientific or socioenvironmental problems affecting their communities). So, they belong to a CoP themselves, which IE-UL partners have been supporting for 13 years centred on pupils' and teachers' activism, and the SSIBL-CoP approach has a lot in common with the initiatives we have been developing previously with this group of teachers.

The CORPOS was developed based on the strong relations (personal and professional) existing between the IE-UL team members and at least one of the school cluster teachers. In each school cluster, this teacher had a very important role in mobilising other teachers (from different levels of education) to the CORPOS. The fact that they work organised in school clusters, provided a context in which internal collaboration between different levels of education already existed. Another important fact supporting both the CORPOS and the CoP development was the fact that each school cluster had one "Science Club", supported by Ciência Viva (our societal partner), aimed at the development of collaborative projects between pupils, teachers, scientists, science centres' members, parents and other community members focused on the inquiry and resolution of local problems that the school community would like to address. This "Science Club" was an important pivot for all the activities.

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The CORPOS was maintained/supported by the strong collaboration and the shared culture/interest (between the IE-UL team and the main teacher from each school cluster) in terms of the importance attributed to inquiry and activism initiatives implemented by pupils and teachers. As already mentioned, this culture has been developed over a 13-year long process of collaboration associated with a CoP centred on such initiatives.

The contacts with the CORPOS were established both through videoconferences, phone calls to the main teachers involved and visits in person to the schools by IE-UL members.

Due to the Portuguese specific context (marked by strikes from the school teachers and workers, and a high workload), we used a more condensed structure, respecting the three conceptual dimensions of SSIBL, but just 4 hours long. This way, we dedicated less time and discussion to these components. Table 4.1 provides an overview of the SSIBL-CoP implementation that took place in this first cluster school. The presentation of COSMOS (project and approach) and the participants, together with the school-cluster characterisation regarding openness attributes, took us around one hour. A period of 1.30h approximately was dedicated to the SSIBL framework, the problem selection and the definition of possible activities. Overall, the phase to which we dedicated more time was the reflection about: a) the COSMOS implemented activities; and b) the factors affecting in a positive or a negative way the levels of different of school-openness dimensions (1.30h).

Table 4. *SSIBL – CoP implementation with primary school 1 in Portugal*

SSIBL dimension	Description	Duration
ASK	Key SSI question: How to live in a planet that shakes? Are we ready for an earthquake? The teacher based all the activities in the worries (and all the questions) of the pupils about a possible earthquake happening in Portugal and the readiness level of the country for such a event. Pupils' questions and worries were motivated by the earthquake (with severe consequences) that had just happen on that time in Turkey and Syria. And Portugal is a place with high seismic activity.	Task 1 (1h approx.)
FIND OUT	Pupils were analysing some news about the earthquake that happened in Turkey and Syria and all its tragic consequences. They also discussed about the tragic Portuguese experience with the earthquake of 1755 that destroyed Lisbon (and other areas of the country), killing between one third and one half of the population.	Task 2 (1h approx.)

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	Pupils were remembering the earthquake drills in which they were participating in school in the past. In the following task, pupils were inquiring (using books, Internet and videos) about the causes of the earthquakes (plate tectonics) and building models of the internal structure of the planet Earth. In this phase, they had the support of an expert from "Civil Protection" who visited them in school and discussed with them ways of reducing the probabilities of bad consequences from earthquakes. In the next task, pupils inquired about possible ways to avoid big catastrophes as a consequence of earthquakes. They developed a list of items to observe in order to detect possible risky situations in different buildings and used it in different parts of their school and homes. The results were presented and discussed during classes. During this phase, they were also visited by their school mates of the 8th year (from the subject of Chemistry and Physics) who were presenting their final works on how to prevent fire events in school and at home (e.g. as a result of an earthquake). Then, they built (in groups) a scale model of different rooms of their homes where they signalled the safe and dangerous places during earthquakes. These scale models were also used to simulate an earthquake and to observe the consequences in the rooms with different types of furniture. Pupils discussed ways of preventing different possible dangerous situations inside their homes as a consequence of an earthquake. In the next phase, different groups of pupils prepared emergency kits (inside backpacks, to have at home) with the most important objects necessary during an earthquake emergency. This kits, developed together with their families, were presented during classes.	Task 3 (5 hours approx.) Task 4 (5 hours approx.) Task 5 (5 hours approx.) Task 6 (3 hours approx.).
ACT	To increase the action component of the COSMOS project, many of the activities were planned in order to involve the pupils' families in their development. This way, the formative component reached their families. A video was prepared collaboratively between the teacher and the pupils with what they considered as their most important learnings. This video was published in the social media of the school in order to be presented to the entire community.	Task 7 (4 hours approx.)

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The number of teachers was not the same during the entire project, with some of them being more involved in specific phases (teacher from other subjects collaborating in specific tasks – e.g., teachers of English and Portuguese languages, in this schools' cluster). However, in each cluster we had a least a group of three teachers (1 primary and 2 secondary) that participated in all phases. The COSMOS approach was presented based on concrete examples of pupils' actions taken from out previous CoP. The previous experience of some teachers with a very similar approach facilitated the understanding of the COSMOS approach.

The SSIBL theme (How to live in a planet that shakes? Are we ready for an earthquake?) was decided mainly by the school teachers of the CORPOS, based on their knowledge of the pupils' characteristics and interests and of the curricula of the different school levels of education and subjects involved. The intervention of both IE-UL and Ciência Viva members were mainly through the suggestion of possible activities and collaborations. However, all the activities were developed mainly by the teachers' group, with a high degree of independence from the other CORPOS members.

The selection of members for the CoP was done mainly by the teachers and according with the specific context resulting from the selected theme by each school cluster and the strikes that were happening during that period. Other CORPOS members had an important role suggesting possible collaborations, discussing/improving the planned activities with the teachers and supporting teachers and pupils through local visits to the classes where the activities were being implemented.

SSIBL-CoP Implementation in School 2

This text is similar with the one prepared for the previous case, because the conditions were very similar. Some of the TPD sessions were implemented through joint sessions with the two school clusters. As with School 1, teachers in this second school cluster were part of the CoP we have formulated over 13 years of collaboration on the topics of activism and inquiry-based science education.

The CORPOS in this second cluster school, was similarly developed based on the strong relations (personal and professional) existing between the IE-UL team members and at least one of the school cluster teachers. In each school cluster, this teacher had a very important role in mobilising other teachers (from different levels of education) to the CORPOS. The fact that they work in school clusters, provided a context in which internal collaboration between different levels of education already existed. Another important fact supporting both the CORPOS and the Cop development in School 2 was the fact that each school cluster had one "Science Club", supported by Ciência Viva (our societal partner), aimed at the development of collaborative projects between pupils, teachers,

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scientists, science centres' members, parents and other community members focused on the inquiry and resolution of local problems that the school community would like to address. This "Science Club" was an important pivot for all the activities.

The CORPOS was maintained/supported by the strong collaboration and the shared culture/interest (between the IE-UL team and the main teacher from each school cluster) in terms of the importance attributed to inquiry and activism initiatives implemented by pupils and teachers. The contacts with the CORPOS were established both through videoconferences, phone calls to the main teachers involved and visits in person to the schools by IE-UL members.

Due to the Portuguese specific context (marked by strikes from the school teachers and workers, and a big workload), we used a more condensed structure, respecting the three conceptual dimensions, but just 4 hours long. This way, we dedicated less time and discussion to these components. Table 4.2 provides an overview of the SSIBL-CoP implementation that took place in the second cluster school in Portugal. The presentation of COSMOS (project and approach) and the participants, together with the school-cluster characterisation regarding openness attributes, took us around one hour. A period of 1.30h approximately was dedicated to SSIBL, the problem selection and the definition of possible activities. Perhaps, the phase to which we dedicated more time was the reflection about: a) the COSMOS implemented activities; and b) the factors affecting in a positive or a negative way the levels of different of school-openness dimensions (1.30h).

Table 4.2. *SSIBL – CoP implementation with primary school 2 in Portugal*

SSIBL dimension	Description	Duration
ASK	Biodiversity loss: what are the causes, the consequences and the possible actions to avoid this problem? All the activities began with one school vegetable garden developed and maintained by the teacher and the pupils. This garden was used to detect different kind of living beings and to discuss the role of each one of them in the ecosystems and the necessary conditions for their survival. Different plants and animals were observed and represented through drawing by the pupils. A special attention was given by pupils to the insects and all their actions in the ecosystems.	Task 1 (5h approx.)
FIND OUT	Pupils inquired and discussed about the different kind of living beings observed in the school garden, the role of each one of them in the	Task 2 (10h approx.)

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	ecosystems and the necessary conditions for their survival. Pupils resort to books, videos and internet. It was discussed the ecological perspective about the insects, in which they have specific roles in the ecosystems, and the human perspective, valuing some insect actions (e.g. pollination) and fighting other actions (insect plagues). Several written and illustrated documents were developed by the pupils with their conclusions. In the next task, pupils had the opportunity to visit one science centre and to participate in one workshop (prepared specially for them) about insects and their importance in the functioning of the ecosystems. There, they had the opportunity to discuss all their findings with one entomologist and to learn many other relevant information about insects and their importance for the ecosystem.	Task 3 (5 hours approx.)
ACT	The action component was quite affected by the strikes in the schools. The exhibition and the presentations (open to the community), planned for the end of the school year, didn't take place. The written and illustrated documents developed by the pupils were the main action initiative.	Task 4

The number of teachers was not the same during the entire project, with some of them being more involved in specific phases (teachers from other subjects collaborating in specific tasks – e.g., Visual Education teacher in this cluster). However, in each cluster we had a least a group of three teachers (1 primary and 2 secondary) that participated in all phases. The COSMOS approach was presented based on concrete examples of pupils' actions taken from out previous CoP (the one that we have been supporting for 13 years). The previous experience of some teachers with a very similar approach facilitated the understanding of all approach.

The SSIBL theme (biodiversity loss) was decided mainly by the school teachers of the CORPOS, based on their knowledge of the curricula of the different school levels of education and subjects involved. All the activities were developed mainly by the teacher group, with a high degree of independence from the other CORPOS members. The intervention and support offered by both IE-UL and Ciência Viva partners was mainly through the suggestion of possible activities and collaborations. However, one entomologist from Ciência Viva had an important role through the organisation of a practical workshop for pupils about the role of insects in the ecosystem. This workshop took place in a big Science Centre that the pupils had the opportunity to visit.

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The selection of members for the CoP was done mainly by the teachers and according with the specific context resulting from the selected theme by each school cluster and the strikes that were happening during that period. Other CORPOS members had an important role suggesting possible collaborations, discussing/improving the planned activities with the teachers and supporting teachers and pupils through local visits to the classes where the activities were being implemented.

4.2. Reflections on facilitation, support and implementation within each participating primary school in Portugal

In this section, we reflect on the ways we have facilitated, supported and worked together with CoP to implement the SSIBL-CoP activities with our two participating primary school clusters. Our reflections address both clusters as the work we have done in these clusters is similar.

Reflections on CORPOS work

The CORPOS was created, maintained and supported by the strong collaboration and the shared culture/interest (between the IE-UL team and the main teacher from each school cluster) in terms of the importance attributed to inquiry and activism initiatives implemented by pupils and teachers. As mentioned, this culture has been developed during a 13 year-long process of collaboration associated with a CoP centred on that kind of initiatives. So, we were quite successful approaching school staff who: a) have been involved with us in previous projects; b) were motivated to work with us; c) already shared a common repertoire with us regarding the implementation of inquiry and activism initiatives in schools; d) have positions of leadership regarding pedagogical innovation and project implementation in schools.

We also faced some obstacles to CORPOS development: a) the strike affecting the school functioning; b) time constraints and a work overload experienced by many teachers; c) lack of teachers' motivation to participate in long TPD processes; d) only a reduced number of teachers wanted to participate in the project.

Reflections on CoP work

The CoP was created for each cluster school but with a reduced number of members. The majority of the external members did not have the motivation or the willingness to be involved in all three SSIBL dimensions; they were only available for some fast contributions involving visits to the schools. The teachers also had some difficulties planning and establishing collaborations with external groups/institutions.

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The CoP development was possible due to the previous personal and professional relations between the teachers and the IE-UL team and also between the teachers themselves. Without these previous successful experiences between different elements, the CoP would become quite difficult to achieve, especially because of the contextual challenges we have phased in Portugal during this year (i.e. teacher strikes). The CoP was facilitated by the previous experience of collaboration between different school levels and between schools from the same cluster.

Reflections on SSIBL-CoP implementations

The main challenge we phased in implementing SSIBL-CoPs with our cluster schools was the strike of teachers and school workers that affected both school clusters. Several classes were suppressed, and consequently, several COSMOS previously planned activities were minimised or cancelled.

The SSIBL-CoP design and implementation was facilitated to a great extent by the previous experience/involvement of some teachers in a CoP (created by IE-UL) centred on pupils' and teachers' activism: the SSIBL-CoP has a lot in common with the initiatives we have been developing. The CoP was quite effective in promoting collaborations between school levels. However, the collaboration with external institutions or groups was quite affected by the strike and the consequent "reduced mode" implemented by schools. The ACT phase of SSIBL, was also affected by the strike and the suppression of several classes and action initiatives.
All three SSIBL dimensions were accelerated by pupils' enthusiasm, in spite of the implementation of the majority of COSMOS' activities at the end of school year, when they have a lot of work and are already tired.

The school leadership of each school had the important role of supporting teachers and pupils' involvement and participation in COSMOS. They were not directly involved, but they were supporting of the COSMOS approach and did create any obstacles. Overall, the SSIBL-CoP implementations were received quite well in both school clusters. Pupils enjoyed a lot the activities and the learning component was evident. Teachers mentioned that they always appreciate collaborating in this kind of projects because they allow them to learn more pedagogical knowledge and to continue implementing activities combining science education, citizenship education and school activism.

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4.3. Lessons learned and next steps for Round 2 implementation

The key lessons learned from our Round 1 SSIBL-CoP implementations and next steps for Round 2 implementation are:

- Next year, all the process will begin much sooner than this year, in order to allow a much calmer and better planned implementation of COSMOS activities. Together with all the teachers from the school cluster, the CoP decided to begin the next year activities around the beginning of October.
- The CoP decided to make an effort on increasing the participations/involvement from external community members. This year, many planned activities were not implemented due to strikes affecting the normal school functioning.
- The CoP also decided to make an effort on increasing the number and range of action initiatives in the community around the schools. This year, many planned activities were not implemented due to the strikes and the consequent suppression of several activities planned for those days.
- The CoP members became more aware of their school cluster limitations regarding the level of openness to community. So, they decided to focus next year efforts in improving the connections and collaboration with external members of the community.

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5. Israel Report (Partners 6 & 12, BBC/MOE)

5.1. SSIBL-CoP Implementations: CORPOS, CoP, SSIBL

Regarding the establishment and maintenance of CORPOS, in Israel the same process was conducted in all 4 schools: We selected the schools for the project via an open call. From dozens of responses, a handful schools were selected with whom we conducted two communication events (the first was long distance and the second was face-to-face). In these events we introduced the basic COSMOS method and concepts, and the schools began thinking about which teachers will participate in the project. Based on these events we selected, via various criteria, a final group of schools (3 primary and one secondary).

Once the schools were selected, prior to the first meeting with each school, they were asked to determine which internal and external members would be present in the first meeting with the COSMOS teams. The members that were present in this meeting constituted the initial CORPOS. In all the participating schools, this initial CORPOS also included 2 HEI COSMOS partners (rotating) and in the primary schools also a societal partner from the MoE. The COSMOS team, especially the BBC partners maintained ongoing correspondence and contact with the participating school CORPOS members. In each school there was a leading CORPOS member that was in continuous contact with the COSMOS partners, but in all the TPD and implementation meetings conducted in the schools, all the school CORPOS members participated.

SSIBL-CoP Implementation with Primary School 1

School 1 entered the project with an initial SSI (school learning garden). The SSI gradually changed to that finally selected for implementation. This original topic evolved to exploring birds in the school premises, and finally to exploring the in-school animal farm. The changing of the SSI was driven mainly by the aim of accommodating to the pupils' interest which was directed to the animal farm in their school. Table 5.1 presents an overview of the SSIBL-CoP implementation that took place with School 1.

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***Table 5.1**. SSIBL-CoP Implementation with primary school 1 in Israel*

SSIBL dimension	Description	Duration
ASK	Key SSI question: What are the interconnections among the animals in the school animal farm and the surrounding school community? After an initial discussion around this key question, the pupils voiced their interest in exploring the domesticated animals and wildlife species in the animal farm in the school from the perspective of its connections with them and their community. An exemplar inquiry question was: How can we improve the conditions of the animals in our school farm?	One lesson
FIND OUT	In their science lessons and the activities conducted, the pupils developed their inquiry skills: in the school animal farm they learned how to conduct observations in-situ and document data. In the computer classes they learned how to search information on the web, evaluate the relevance of information to the inquiry question and summarise relevant information. Additional lessons and activities in the unit were: • A lesson dedicated to aiding stray domesticated animals, that was given by a teacher who takes care of street-cats. • A fieldtrip to the animal farm in the municipal park to learn from the staff how this animal farm works. • An activist from an NGO for the protection of wildlife also came to the school to give a class.	Several lessons (10 hours approx.)
ACT	• Act at the school level: The CoP pupils conducted classes for lower age levels in their schools. • Act at the local community level: The CoP pupils went into the neighbouring kindergarten and conducted activities for the kindergarten children around animal and wildlife protection. • ACT at broader community level: They prepared hedgehog homes for the NGO.	A full school day

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The first step in creating the CoP was selecting the teacher team. This was based on those teachers with a background as well as interest in inquiry-based learning. High motivation to invest time in the project was one of the criteria in deciding which teachers would participate. Once this was determined, the second step was choosing pupils that would be CoP members. The teacher team invested time in selecting pupils highly motivated to invest time, who are responsible, and curious about science topics. Towards this goal, pupils were requested to prepare and present to their peers in class a PPT presentation. Once the pupil CoP members were selected, regular weekly hours to be dedicated to the project were allocated for teamwork and for the learning activities. Out-of-school community members that joined the CoP were based on their interest, affiliation and experience in the topic selected for the CoP. To allocate these, the school team contacted various local and national groups and organizations involved in nature and animal protection in Israel to join as external stakeholders, as well as parents.

SSIBL-CoP Implementation in Primary School 2

The process of creating the CoP and selecting the SSI with our second primary school cannot be disentangled; the two emerged together. The CORPOS leadership team together with representatives of the parental committee of the school discussed ideas for an SSI around which a CoP would be formed. Given that the school is situated in a rural environment, and is itself situated in a communal village, it was clear that some issue concerning green, circular, and communal economy would be chosen. Many of the families in the village have businesses that have a connection to agriculture, community-gardens and honey-making farms. The issue of the disappearance of bees was chosen since this is an issue that nearly all families are concerned about. After the SSI was chosen, an open letter was sent to all the school community (families) to request the participation of those in the community who have knowledge and are willing to contribute to the learning and those who would like to participate in the CoP. Additionally, a mapping of the different local stakeholders who are relevant to the SSI was conducted, and following this, bee-experts and an organisation involved in the protection of bees were contacted to participate in the learning process. Table 5.2 presents the SSIBL-CoP implementation on the SSI of bee extinction carried out by School 2.

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Table 5.2. *SSIBL-CoP Implementation with primary school 2 in Israel*

SSIBL dimension	Description	Duration
ASK	Key SSI question: Why are bees disappearing and what can we do to address this? Following TPD sessions, the leadership team (CORPOS) together with parent representatives, decided the theme of the SSI together.	2 COSMOS project Meetings
FIND OUT	Several lectures were conducted by experts and parents that were invited to share their knowledge and experience regarding beekeeping, bee-friendly gardening, honey extraction and other related topics. A family field trip was conducted to a 'free farm' in Jerusalem to learn about how beekeeping techniques, managing beehives. The purpose was to gain knowledge and to familiarize both pupils and parents to the SSI. A lesson dedicated to learning about how to build a beehive (connected also to ACT) A peak day was conducted dedicated to learning about beekeeping, various activities related to bees (involving other school subjects).	3-4 lessons Whole day (5 hours) 2 lessons Whole day (6 hours)
ACT	Activity to create Beehives for the community The creation of a pollinating garden – a collaboration between the school and other local organisations to create a pollinating garden on the school grounds and in the community garden. Flowers and trees were chosen. Both pupils and families were invited to take part in the activities. An art competition on the subject of bees – a contest was declared in the school for works of art (by the children) on the subject of bees. The winners of the competition were mentioned in the village newspaper to disseminate both the activities and the addressing of the SSI.	1 lesson Whole day (6 hours) Ongoing activity

The design of the learning activities was mostly conducted by the school leadership team, participating teachers and other community stakeholders that were invited to participate. COSMOS project team

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was involved mainly in TPD sessions to promote a community approach and a deeper understanding of SSIBL – these sessions established a shared understanding of how to apply the COSMOS method within the design process.

SSIBL-CoP Implementation in Primary School 3

As the aim in this school was to connect the SSI project to many school subjects, the team included science teachers, a language teacher, and teachers with additional social roles in the school. A group of pupils was selected to function as a pupil leadership team, as well as several parents. The Headteacher exposed the project to the whole school at its onset. The selection of the SSI and the TPD process were linked. The school entered the project with an initial SSI – 'Coping with STRESS'. The TPD process with the COSMOS team led to a rethinking around what SSI is deeply relevant to the local community and can enable the involvement of diverse community members. This led to selecting 'Promoting healthy lifestyles in our community'.

Table 5.3. *SSIBL-CoP Implementation with primary school 3 in Israel*

SSIBL dimension	Description	Duration
ASK	Key SSI question: How will a healthy lifestyle affect our community? How can we promote adopting a healthy lifestyle in our community?	One lesson
FIND OUT	Several classes were conducted with the school counsellor, with parents, with dieticians who shared their knowledge and experience regarding different aspects of a healthy lifestyle - healthy diets, sport, social connections, etc. A Peak day event was conducted including diverse activities around the different aspects of healthy lifestyles in which diverse CoP members conducted the activities – doctor's lecture, dieticians' workshops, grandparents shared knowledge and experience around cultural traditions for maintaining health, the pupil leadership groups gave lectures, preparing healthy diet pyramids,	Several lessons Whole day – 5-6 hours
ACT	This is embedded in the essence of the project: active engagement of the pupil leaderships group, of parents, of grandparents, of the municipality, of local health organizations, etc. reflect action for benefiting the community via its engagement in the learning process.	All were ongoing throughout the implementation of the learning project

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	A health group was established with a group of overweight pupils who entered a follow-up monitoring diet plan with a dietician. The pupil leadership/focus group gave lessons.	

The discussion conceptualizing the SSI included a mapping of the issue (a concept map) which essentially involved a stakeholder analysis to identify role players in the town (different positions held in the town) who are relevant to the issue as potential CoP members. The aim was to include as many stakeholders as possible so that the whole school community would benefit from the process. The team first addressed the question: What does being a community mean for us? What characterizes a community? Where are we currently at? What is our vision of the future? What is our role in getting there and how can we get there? How can we promote learning as a community in our specific community? What are the human resources available in our community to achieve this?

Establishing the CoP took place in stages: first, the school members were selected – the pupil core team (from 4th, 5th and 6th grade) and teachers (a total of 19 from diverse subjects). Then, [out-of-school] community members were selected. These were selected from the relevant stakeholder groups identified in the concept mapping: the doctors' union, dieticians, sport centre, senior members' [old age] home, parents. With some of these CoP participants (parents, grandparents, senior citizens' home) the school shad connections prior to the project. After the CoP was selected, they commenced the co-design of the implementation: subject -matter, various programs to incorporate, dates for implementation including the peak event, when the different CoP members would be involved and coordinating with them, where the different activities would take place, contact persons.

5.2. Reflections on facilitation, support and implementation within each participating primary school in Israel

This section opens with an overall view pertaining to the experience of the process as a whole with all three participating primary schools. Following, we address each of the three primary schools separately.

Overall, the recruitment process of schools that we conducted in Round 1 led to the formation of the CORPOS. Step 1 (identifying participating schools) and Step 2 (instigating preliminary CORPOS) of the COSMOS framework for formulating CORPOS occurred as part of the recruitment process. Prior to conducting the first meeting in each school, we had conducted (during the recruiting process) three meetings in which the central concepts and ideas of COSMOS were communicated, leading to the

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awareness of the importance of creating a CORPOS. Resulting from this, the first meeting conducted individually with each school was conducted with a CORPOS, which included teachers who represented different school subjects (e.g., art, language in addition to science) and different roles (e.g., homeroom, social consultant) and often external stakeholders (e.g., representative of parent association, local municipal representative).

Step 3 (CoP creation meeting) was conducted in the Israeli context as part of the TPD process – identifying the SSI and identifying potential external CoP stakeholders for the selected SSI. Overall, the further process of development and implementation the SSI unit (including the timeline) was conducted independently by the schools. We know that external stakeholders were involved in the SSI units, but we cannot determine definitively their extent of involvement as active CoP members in the development of the units. This is one of our aims for Round 2.

Step 4 – was not conducted as laid out in the initial COSMOS framework produced by Work Package 2. At this stage, the school teams were fully engaged in developing and implementing the SSI unit and did not have the time or capacity to give attention to the role and responsibilities of the CORPOS. Additionally, the majority of the CORPOS members were involved in the implementation of the SSI-CoP. To our understanding, specific and deep attention to the CORPOS and its function within the school organization should be a focus of COSMOS activities with continuing school in round 2.

In general, the schools were passionate and highly motivated around the selected SSI, and this resulted from the process of selecting the SSI, which in each case, was a relevant topic for the school and local community. In the schools in which the Headteacher was deeply involved in the COSMOS project, this provided the leadership that evolved into a successful SSIBL-CoP implementation. We encountered two schools that represent opposite poles regarding the Headteacher's leadership style – one highly centralised (i.e., authoritative) and the other reflecting more shared governance. In both cases, despite the differences in leadership styles, the Headteacher's involvement and support was a key factor in the process that played out in the school. In the school in which the Headteacher was not involved in COSMOS, the level of implementing SSIBL-CoP was low; we identify this as an outcome of lack of the Headteacher's involvement in the project.

Another factor to reflect on was the involvement of governmental ministry that supported CORPOS and CoP engagement. In the Israeli context, the fact that The Ministry of Education provided financial support to the participating schools, was a significant success factor in the schools' ability to allocate sufficient time for the teachers' involvement in the project. Other success factors included the close working relations that were established between the school teams and the HEI and social partner (i.e., project team), which created a high level of trust, and the recognition of the contribution of a

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successful CORPOS to a productive CoP. The recruitment process of the schools, which proved an important success factor in round one, had implications regarding the time that was available for developing and implementing the SSI units. The ability to invest in SSIBL-CoP implementations requires starting the process at an earlier time in the school year.

The selection of the SSI was conducted as a co-design process involving the CORPOS members including the HEI and societal partner. The implementation of SSIBL, after the SSI was selected, was conducted more or less independently by the schools. While they consulted with the HEI and societal partner, they opted to work more independently. We identify this as an area to be addressed in the next round as it influenced the way the teams worked around the different SSIBL dimensions. Regarding the different dimensions of SSIBL, our impression is that there is room to deepen the way the schools addressed each of them, especially the FIND OUT and ACT dimensions. This is one of our aims for Round two. Regarding the integration between SSIBL and CoP, while diverse stakeholders were involved in implementing the learning units, we feel that this was somewhat instrumental and that the deep attributes of being a member of a CoP were not fully realized (e.g., ownership, co-agency, shared leadership, etc.). One of our aims in Round 2 will be to address this, whether with new schools or continuing schools.

In our view and based on the mini conference conducted at the culmination of the school year/Round 1 with representatives of all the participating schools, the project was positively experienced by its participants in all the primary schools. This is also evident in the interest of all three schools to continue in the COSMOS project for another Round despite the significant resources it entails on the part of the school teams.

Reflections on CORPOS, CoP & SSIBL-CoP implementation with School 1

The CORPOS was created as part of the recruitment process. The school CORPOS members (Headteacher and several teachers) were dedicated to the project which were highly engaged; a direct line of communication was maintained throughout the implementation, and no efforts were necessary on the part of COSMOS members to maintain communication.

A noteworthy and unique success factor regarding the CoP in this school is in the choosing of the participating pupils: pupils interested in taking part in COSMOS were required to prepare and present a presentation of their reasons of interest and willingness for commitment. This led to a dedicated pupil group with a high level of curiosity and interest in science. Additionally, efforts were invested in choosing the teacher team. Another success factor that can be identified with this school lies in the process via which the final SSI was selected; the pupils had a strong voice in identifying the final SSI,

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which is founded on a component and ecological resource of the school (the existing school animal farm), thus contributing to their high interest in the issue.

The school team was largely autonomous in developing the SSIBL implementation (which involved several community stakeholders). The implementation included the three SSIBL dimensions, but these could be addressed more deeply and significantly. More thinking around diverse inquiry questions stemming from the SSI will lead to richer and more meaningful inquiries. While the ACT stage included pupils teaching kindergarten children, there is room for diverse significant actions around local animal welfare.

Thus, to our understanding, the involvement of additional relevant stakeholders in the CoP and their involvement in the co-design process can be enhanced to lead to a deeper, more significant implementation of SSIBL.

Reflections on CORPOS, CoP & SSIBL-CoP implementation with School 2

As mentioned above, the CORPOS was created as part of the recruitment process and was further developed throughout the TPD sessions. In School 2, from the outset (from first meetings in school after the recruitment process was finalised), we encountered a dedicated CORPOS team which was composed of the school Headteacher, a diverse team of teachers, community members and municipality representative. The communication was always positive and no further steps were taken to enhance engagement and communication.

The main success at School 2 is the deep and dedicated involvement of the school Headteacher in all COSMOS processes and this was particularly the case in the CORPOS. The Headteacher was very supportive of the project, and it was clear that the extent of shared governance was relatively high – allowing many voices to be heard and taken into account. No real obstacles were encountered as a result of the dedication of the CORPOS and the engagement of the school community to the process. An additional success was the diversity of stakeholders in the CORPOS – a truly multidisciplinary leadership team – which also has an impact on the CoP, particularly the engagement of parents in the process.

One of the main successes of the CoP is perhaps the dedicated participation of parents and community-members in the learning process. Parents were involved from the beginning both as experts in the SSI addressed, or as participants in learning (family field trips, peak days, various ACT activities etc.). Additionally, the participation of other stakeholders, expert beekeepers, organizations, provided additional knowledge. The dedicated response by community members can be attributed to

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the participation of parents in the selection of the SSI (bee husbandry) and the research questions (why are bees disappearing?). Additionally, the fact that the SSI reflected an authentic issue that was meaningful to most village-community members increased involvement and participation. The open letter to the community was a powerful tool to promote engagement.

Thus, in terms of success factors, identification was relatively strong, although ownership by pupils and other stakeholders could be enhanced. Leadership in School 2 was highly dedicated and involved, both the Headteachers and CORPOS members. The active involvement of the MoE in the project certainly has an impact, particularly the additional financial support that was given to each participating school. The ability to allocate dedicated hours to promoting COSMOS was clearly advantageous. Furthermore, the good working relations among CORPOS team members had a positive contribution to the success of the CoP. Mapping the stakeholders was also a powerful tool in making the right connections and for involving various stakeholders.

The main challenge, to our understanding, is enhancing the participation of pupils in the design process and SSI selection process – even in the case of primary school pupils. Additionally, generally speaking, the co-design process could be increased so that stakeholders could be more involved in the planning process as well as in the learning itself (and not merely as 'external' expert lecturers).

The School 2 team was mostly autonomous in the design process. Co-design in School 2 was conducted mostly between school teams and community representatives. The three dimensions of SSIBL were relatively developed particularly the ACT stage which is the more challenging stage. In this school there was broad engagement of the community in creating solutions (beehives, community garden, local newspaper). The success of these elements can be attributed to the active and serious engagement of the school team in the TPD sessions (session 4) and the deep understanding of the COSMOS approach and aims. To repeat, pupil participation in the co-design process is still a challenge and needs further thought, as well as the deeper involvement of other stakeholders in thinking about the SSI and the three SSIBL dimensions.

Reflections on CORPOS, CoP & SSIBL-CoP implementation with School 3

CORPOS was created as part of the recruitment process. In this school, from the first meeting in school after the recruitment process was finalised, there was a dedicated [school] CORPOS team composed of the school Headteacher and several teachers. Communication was always positive and enthusiastic, there was no necessity to create engagement and communication.

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A major success factor is the dedicated involvement of the Headteacher in the COSMOS project and mainly the notion of engaging the surrounding community in learning in the school. This is one of the central visions of this Headteacher, evident in previous initiatives involving the participants from the community. The teachers follow their Headteacher's vision, and this lead to a highly engaged CORPOS.

While the CORPOS team was comprised of participants from the schools (aside from the COSMOS members), the CoP that was established around the SSI was comprised of diverse members relevant to the selected SSI, each bringing in a different perspective and leading to a rich learning experience for the pupils as well as the CoP members.

In our view, the crucial success factor of school leadership is also a main challenge. The Headteacher in this school reflects the highly centralized leadership approach. Thus, a challenge with this school context is a promoting more room for the teachers' voice.

In this school, the design process was conducted by school team. Community CoP members were consulted throughout the design process and were involved in the implementation. Success factors, as identified by the school itself were: an enabling Headteacher, a dedicated and professional team of teachers, highly active pupils, high level of collaboration of other teachers, the voluntary approach of the community members. Challenges, as identified by the school: coordinating with community stakeholders, time investment, funding, certain oppositions.

The three SSIBL dimensions were relatively well developed. Team discussions and concept mapping led to well-conceptualised ASK; the involvement of relevant community members reflecting diverse perspectives led to rich FIND OUT. The ACT component was largely evident in the case of this school in the high-level of involvement of the community members around different aspects of a healthy lifestyle, which led to a rich and meaningful experience for all the participants. Each participating member – the pupils, parents, grandparent nurse-dieticians, and other representative benefited from the involvement in the project. Noteworthy, regarding 'promoting healthy lifestyle', this is the aim.

5.3. Lessons learned and next steps for Round 2 implementation

The lessons learned from Round 1 implementation can be connected to success factors indicated in the WP2 COSMOS framework. We discuss next the dimensions we will be focusing on in Round 2 both for continuing schools and for new schools with which we will collaborate.

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- **School leadership:** The first lesson is the importance of leadership, especially the involvement of the Headteacher in the various stages – from the selection of SSI to the creation of the CoP. The engagement of the Headteacher in the CORPOS is a significant success factor. Working with the Headteachers – and not only with the teaching staff, on the openness dimensions – and perhaps particularly on 'shared governance' - may prove to be important for enhancing the various openness dimensions of COSMOS in Round 2.
- **Learning in/as a community – CoP – co-design:** The second lesson is that school teams seem to regard external stakeholders more as 'external' or instrumental partners rather than partners in collaboration. We intend to engage schools in the 2nd round to conduct more meaningful co-design processes with CORPOS members (which also perhaps can be expanded to include 'external' community members), selection of the SSI, and apply a more open-community approach to the different SSIBL dimensions.
- **Depth of addressing SSIBL pedagogy:** Closely related to the previous lesson, each SSIBL stage can be made more meaningful in terms of the way the SSIs are selected, deciding on the driving question and the rest of the co-design process. A rich driving question will lead to diverse directions of inquiry. The ACT stage is arguably the most difficult to realise in formal school settings. These elements will receive more attention in Round 2.
- **The resource of time:** In terms of timeframe, time allocation and scheduling, we are aware that the actual implementation stage of the CoP did not have sufficient time in round 1. The lack of sufficient time for implementation, due to the relatively late initiation stage and relatively lengthy TPD process, needs to be addressed in round 2. We intend to begin working with schools much earlier – from the beginning of the school year, so that more implementation time is afforded, and more time for COSMOS routines can be scheduled before and throughout the implementation process.
- **Organizational culture of open schooling:** Finally, the CORPOS element, and generally, the school-wide organizational aspects certainly can be expanded and enhanced. Working more closely with CORPOS members and supporting the school in expanding or diversifying CORPOS membership is an objective that we have set for ourselves in round 2. Close work with the Headteacher as well as other members of school leadership can promote expanding openness at the school-organizational level.

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6. Summary of lessons learned and steps for implementation in the next round

The reflections presented in this section are based on the experiences of our SSIBL-CoP implementations within and across national contexts, bringing together the reflections and considerations for next steps by each pair of partners, identifying key successes of our approach, as well as some common challenges and ways of addressing them. These reflections will serve as important feedback that will inform our TPD workshops and SSIBL-CoP implementations during Round 2, both for new and for continuing schools in each national context. They can also help us start formulating our roadmaps to open schooling (Work Package 6).

Formulating and sustaining a CORPOS is a critical element of the COSMOS approach. The reports in each national context presented in the previous sections, demonstrate that it is viable to have CORPOS teams within schools, but some conditions need to be further considered for CORPOS to be effectively and successfully sustained. Our experiences from Round 1 suggests that since CORPOS teams are a core group within a larger Community of Practice group, the CORPOS needs to consist of members who are invested in this school structure. The CORPOS team is the group of individuals who invest most time on developing and implementing the COSMOS approach within schools. This meant that CORPOS members in Round 1 were predominantly from within the school community of each participating school, and mainly consisted of the participating teachers and headteachers, or other members of school staff and the COSMOS consortium partners in each national context. Initiating collaborations within already existing networks (e.g. Sweden, Portugal) or networks developed through recruitment (UK, Israel) were both effective in establishing CORPOS; the close collaboration between schools and consortium partners required for the TPD workshops and co-design and implementation of activities allowed for strong professional relationships to be formulated which then facilitated further engagement and motivation from all participants. The in-person meetings that all consortium partners had were important and balanced with online communication to maintain contact but without taking too much of the teachers' time. At the same time, forming and sustaining CORPOS was challenging due to external factors such as workload, time and teacher strikes, which meant that not all teachers were able to engage deeply throughout the project duration. Another challenge to consider was the extent to which teachers took ownership of the CORPOS aims, an aspect that is critical in ensuring that the COSMOS approach is sustainable. Thus, as a next step for Round 2, further attention to the CORPOS and its function within schools should be given.

The schools chose to work on important and critical socio-environmental and technoscientific challenges that exist not only at a local level but also at national and international levels; addressing

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such **important SSIs** at the primary school level and through the COSMOS open schooling approach of this consortium provides important and innovative pathways to supporting young children become active and responsible citizens within their school and local communities. Such approaches to using SSIs in primary education are not well established and documented in the literature making the contribution of our COSMOS consortium particularly significant at this educational phase. The choice of SSI topics was mainly conducted by teachers and schools with less involvement directly of pupils in the selection process. Nonetheless, the pupils' interests and needs where taken into account by their teachers across all SSIBL-CoP implementations reported in this deliverable.

CoP formation was dependent on the SSI chosen and then to existing connections and networks of the school and the CORPOS members. For example, when a school choose to focus on a SSI where the consortium partners or school did not have existing networks or connections, as was the case of Sweden, then engaging with a wider range of stakeholders and creating a CoP was more challenging. Where SSIs chosen required external experts who were available but with no pre-existing collaborations with CORPOS members (e.g., Biology researcher and HEI partners in the UK) CoP membership expanded outside the school, but engagement was more temporary or ephemeral relying mainly on one-off interactions with children/teachers (e.g. UK, Sweden). Where strong traditions exist within the schools for working in, and with CoP such as in the case of Portugal, then formulating and sustaining CoP work and opening up the school to their community was less challenging. This suggests that there is a continuum of engagement within CoPs that needs to be considered in order to identify what is the minimum engagement needed for meaningful collaboration and the formation of a CoP, and for meeting our COSMOS objectives. This is a next step identified by all WP3 partners, who note the need to focus further on engaging with stakeholders to make them part of the CoP formulated, and for sustaining this engagement as part of the learning process. WP3 partners acknowledge the need to initiate networking and collaborations with external stakeholders earlier in the school year, to ensure the buy-in needed for sustained engagement within CoP.

A key challenge WP3 partners had to overcome was the **limited time given to teachers** for engaging in professional development and in new ways of teaching and learning. This was an issue that was expected and our WP3 partners were able to mitigate it through adopting flexible ways of collaborating with teachers via online communication and platforms, as well as co-designing of materials and lessons with teachers. The co-design approach taken has been effective in producing a wide range of SSIBL-CoP implementations as shown in the SSIBL-CoP implementation summaries provided by our WP3 partners. These summaries will function as exemplars to be used in our recruitment of new schools for Round 2, as a tool for reflecting on the work conducted with continuing schools when discussing how to further enhance and develop the COSMOS approach within their school and

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communities, and as a dissemination tool in sharing with the wider science education community at national and international levels.

Leadership involvement and support is another critical dimension, upon which all WP3 partners have reflected. Our Round 1 experiences suggest that when it comes to implementing the COSMOS approach, leadership support is critical but involvement is not necessary for successful school engagement and implementation. For example, in schools in the UK and Sweden, the school Headteachers were supportive of the project's aims and of their teachers participating and investing time in the COSMOS project, yet they were not directly involved with SSIBL-CoP co-design and implementations, although they were part of the CoP developed (UK). At the same time, leadership participation beyond the CoP and into CORPOS facilitated greater investment of time and resources by teachers and schools in the case of Israel. This factor is also contextual, since in national contexts where schools are more centrally organised and governed, leadership and teachers have a different working relationship to educational contexts where schools are more autonomously run. For example, in Sweden, teachers preferred for their school leadership to not be actively involved in the co-design and implementation of SSIBL-CoP. Thus, our WP3 work in Round 1 also provides examples of how leadership support and engagement may look like in contexts where school governance is more centrally managed (e.g., Israel, Portugal) and in contexts where schools are working more autonomously (e.g. Sweden, UK).

Finally, a key lesson learned through the work conducted in Round 1 is that **the three SSIBL dimensions** of ASK, FIND OUT and ACT have been successfully integrated and implemented with a CoP element to them. Across the summaries of SSIBL-CoP implementations reported in the previous sections, we can see a range of activities used to do so. A key issue identified is that the ACT dimension was not always implemented, although this was planned. In some cases, actions had to be adapted due to changing circumstances and workloads of teachers (UK), and others due to external factors such as strikes (Portugal). However, in all cases the ACT dimension was considered as part of the TPD workshops and co-design process, and in our next steps, as we continue to strengthen the SSIBL pedagogy within continuing schools and introducing this to new participating primary schools, we will ensure that all dimensions are implemented in combination to a CoP in order to achieve our COSMOS objectives.

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