D. 7.1 How COSMOS contributes to open schooling

Outcomes and process evaluation of implementation rounds 1 and 2

Evaluation Report

Deliverable Documentation Sheet

Title	Report on evaluation of Rounds 1 and 2: impact and process evaluation, lessons learned
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"My students felt empowered by the impact they have as agents of change in small things."
(COSMOS teacher)

""I really enjoyed understanding things that I didn't know so much about, like bees, that they play such an important role and that they are so special..."
(COSMOS student)

COSMOS (Creating Organizational Structures for Meaningful Science education through Open Schooling for all) / cosmosproject.eu

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Executive Summary

Imagine schools that teach science linking children's learning to the world outside. Schools that join hands with local businesses, NGOs or local authorities to make science education more meaningful for their students by showing how science is a real part of their lives.

In these open schools, students learn to ask questions about socio-scientific issues that exist around them, create meaning through inquiry, and collectively find ways to engage in their society as active citizens.

Schools like these have great potential to prepare students for the complexity of the contemporary world, for uncertain futures, for jobs that don't yet exist, and for their role as democratic citizens who want to contribute to a sustainable future.

But how to realize this potential? And what do those involved learn as schools open up to their communities through science education? In this report, we reflect on such questions through the insight gained from the empirical evaluation of the COSMOS project.

Over the course of two school years ('22-'23 and '23-'24), COSMOS implemented science education projects through the SSIBL-CoP approach, in targeted efforts to contribute to an outward movement in terms of school openness of the participating schools. SIBBL is a didactical framework to science education that involves a scaffolded approach to support students in asking authentic questions about socio-scientific issues to matter them (ASK), exploring these issues through scientific, social and personal inquiry (FIND OUT), and then designing and implementing actions on the issue (ACT). In COSMOS, SSIBL was implemented through a CoPs (communities of practice) involving students, teachers, school leaders, SMEs, NGOs, HEIs, local authorities, ... in the design and implementation of science education. These implementations were set up with an outward movement on one the dimensions of the school openness in mind. In total, 2.879 students, 139 teachers, 118 other stakeholders participated in COSMOS through the implementation of 39 projects in 37 schools across 6 countries in Europe and beyond.

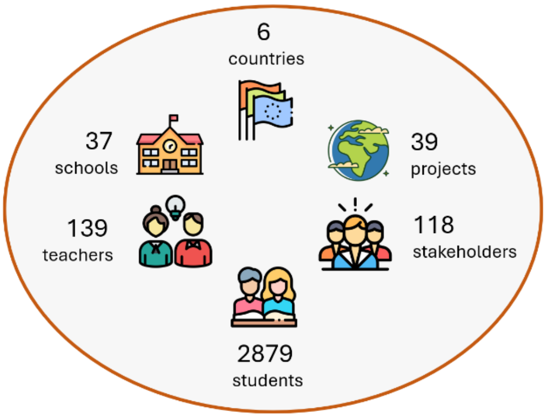

***Figure** 1*. Participants in the COSMOS project

This report is constructed in two main parts. ***Part A*** focusses on answering the projects' evaluation questions, zooming in on stakeholder outcomes (who has learned what?), and the pedagogical and organisational processes that contribute to these outcomes. ***Part B*** presents an initial exploration of barriers and facilitators towards moving schools outwards on respective dimensions of open schooling.

Both parts are fed by empirical data collected across two rounds of implementing COSMOS in primary and secondary schools in *Belgium, Israel, Portugal, the Netherlands, Sweden* and the *United Kingdom*. The evaluation framework of COSMOS involved a mixed methods design, including pre-post implementation *student surveys (2662 participants)*, as well as *87 group interviews with students* and *61 focus groups with members of the communities of practice*. The COSMOS evaluation toolbox guided and harmonized the collection, analysis and interpretation of data.

The main results of the analyses (Figure 1) reveals **a persistent impact** of implementing SSIBL-CoP, across national countries and educational levels. Students who participate in either of the two COSMOS implementation round show an **increased interest in science**, perceive science as **more relevant**, and feel **empowered** to use what they have learned in the science classroom to contribute to a more sustainable future. We observe that these effects are present for the boys as well as for the girls in our sample.

On top of these general effects of participation in COSMOS that are present for the entire sample in the project, some specific or local effects can also be identified in the data (e.g. specific implementations that contribute to some students' **science career aspirations**).

Participating teachers report that designing and implementing SSIBL-CoP into their teaching led to substantial **professional development**, encouraged them to explore student-centred, inquiry-based, and community-oriented approaches. It broadened their pedagogical practices, enhanced collaborative skills, and helped them see the positive impact of teaching science in ways that connect more directly to students' lives and their communities.

In terms of school openness, implementing SSIBL-CoP the evaluation reveals that it has the potential to contribute to a move towards **more open modes of science education** and open schooling in general. These outward moves are highly school specific processes that are influenced by many school related and contextual barriers and facilitators.

Based on these results, and on broader lessons learned from implementing open schooling through SSIBL-CoP, COSMOS has produced concrete recommendations for policy and practice at the level of diverse education actors, including the European Commission, national and local policy makers, school leaders and (science) teachers (Deliverable 6.2). Furthermore, roadmaps towards viable and sustainable implementation of open schooling through the COSMOS approach are presented in Deliverable 6.3.

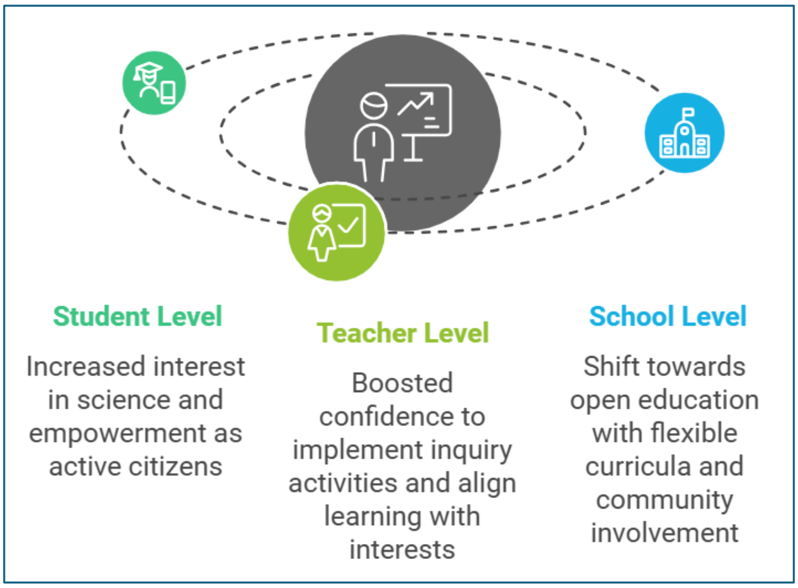

Figure 2. Main results of COSMOS project

Contents

Glossary

Alma Löv	Museum of Unexp. Art
BBC	Beit Berl College
CoP	Community of Practice
CORPOS	Core Organisational Structure for Promoting Open Schooling
COSMOS	Creating Organizational Structures for Meaningful science education through Open Schooling for all
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
OS	Open schooling
PD	Professional development
PLC	Professional Learning Community
PI	Professional Identity
SDG	Sustainable Development Goals
SE	Science Education
SOTON	University of Southampton
SSI	Socio-Scientific Issue
SSIBL	Socio-Scientific Inquiry-Based Learning
STEM	Science Technology Engineering Mathematics
TPD	Teacher Professional Development
TPI	Teacher Professional Identity
UU	Utrecht University
WP	Work Package
WSC	Winchester Science Centre

1. Introduction

1.1 Background: COSMOS project

COSMOS (Creating Organisational Structures for Meaningful science education through Open Schooling for all), which ran from January 2021 to December 2024, uses the engagement of community members as a Community of Practice (CoP) within socioscientific inquiry-based learning (SSIBL) as a pedagogical means for opening up schools to their communities as well as the project establishes Core ORganisational structures for Promoting Open Schooling (CORPOS – Open schooling teams) in primary and secondary schools to facilitate community engagement. This involves a transformation process, aiming to create new partnerships within communities that can foster science education for all citizens, irrespective of gender, ethnicity or cultural background.

COSMOS' overall aim is to create open schools with partnerships within their communities that foster science education for all citizens. To achieve this aim, we have set out three interconnected objectives as illustrated in Figure 3.

To transform and open schools from an 'inwards' to an 'outwards' mode of engagement in, with and for their communities (see also the COSMOS conceptual framework, D2.1), our open schooling approach is unique in combining key pivotal elements of innovative constructivist pedagogy, teacher education, and transforming school organisational culture.

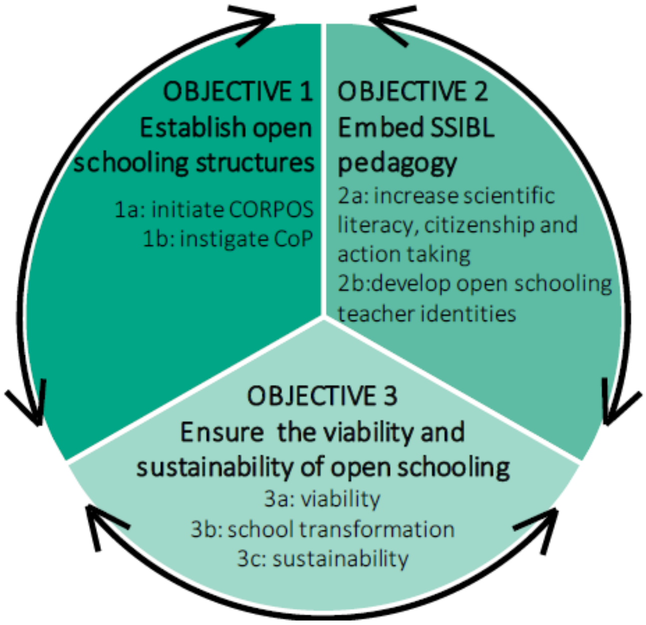

***Figure** 3.* Interconnected objectives

Throughout the project's lifetime, we (a) established Core Organisational structures for Promoting Open Schooling (CORPOS) in the participating primary and secondary schools to facilitate community engagement. These CORPOSs (b) supported the creation of Communities of Practice (CoP), including non-formal and informal education providers, enterprises, families, and other stakeholders. Finally, our third objective was to (c) ensure the viability and sustainability of open schools by working closely with science teachers, stakeholders and school leadership, offering teacher professional development, supporting networking and collaboration and capacity building.

The COSMOS consortium (12 partners, 7 countries) provides transdisciplinary cooperation and expertise in non-formal and formal science education, science teacher education, educational organisation and leadership, and strong societal links within communities, all of which warrant the successful implementation of COSMOS.

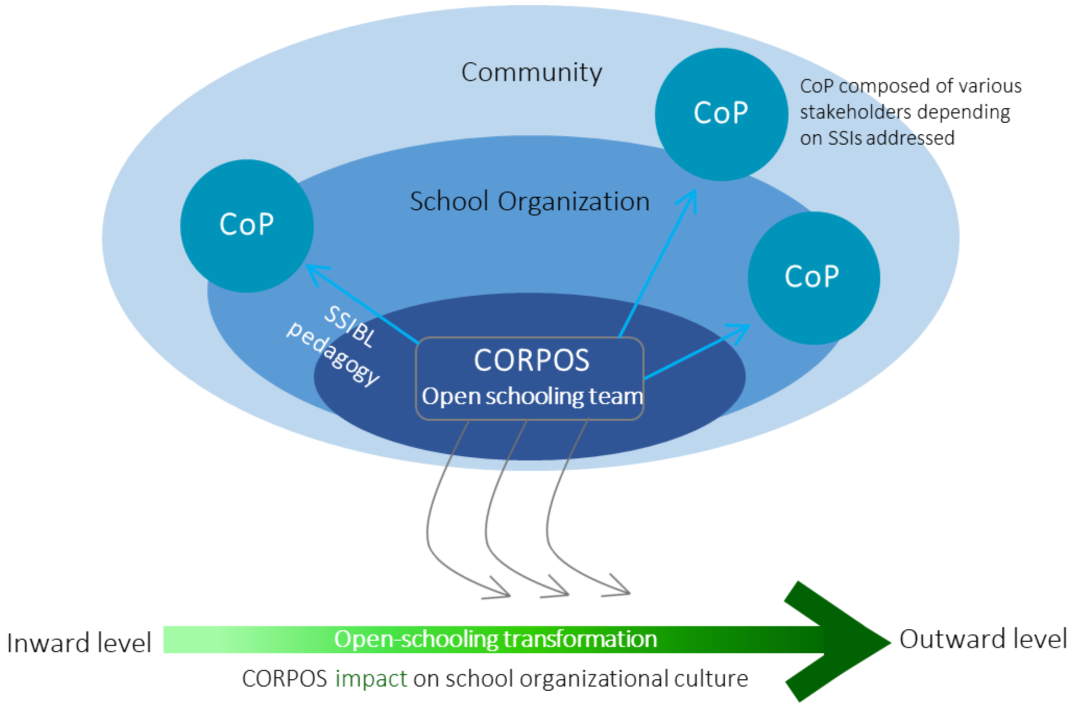

***Figure** 4.* Components and process of open schooling transformation in COSMOS

***Table** 1.* COSMOS Timeline: preparation stage - two implementation rounds - finalization stage

Preparation m1-m6 Jan 22 – Jun 22	**Round 1**		**Round 2**		**Finalization** m31-m36 Jul 24 – Dec 24
	Initiation m7-m12 Jul 22 – Dec 22	**Implementation** m13-m18 Jan 23 – June 23	**Initiation** m19-m24 Jul 23 – Dec 23	**Implementation** m25-m30 Jan 24 – Jun 24	
	Preparatory activities	SSIBL-CoP implementation in COSMOS schools	Preparatory activities	SSIBL-CoP implementation in COSMOS schools	

The project's timeline comprised a preparation stage, two implementation rounds and a finalization stage in which the results were consolidated as you can see in Table 1.

The **preparation stage** focused on:

(a) Identifying school partnerships within the existing national and regional school networks of the project's partners (both HEI and non-formal education partners);
(b) Developing a COSMOS evaluation framework and associated approaches and assessment tools;
(c) Creating a rigorous COSMOS dissemination, exploitation and communication plan (PEDR).

Both implementation rounds had an **initiation stage**, focusing on establishing CORPOS, and determining the participating schools' current level of openness, in order to set the baseline for their further development. Also within this stage, activities such as workshops for potential stakeholders to discuss and select SSIs which are relevant to the school and local stakeholders were conducted. Based on these discussions CoPs were formed and teacher professional development activities were organised to foster teachers' open schooling identity and capacity building. As part of these activities teachers and other CoP members created collaboratively SSIBL based teaching materials and designs of the educational activities planned. In the **implementation stage**, the SSIBL-based educational activities were implemented by the CoP and evaluated by the HEI partners.

In the **finalization stage** we worked within our national and transnational teams to reflect on our findings from the two implementation rounds, finalized our dissemination and exploitation products (e.g. roadmaps and policy briefs) and further intensified our dissemination and exploitation actions at all levels of engagement.

1.2 Purpose of the report

This report aims to draw on evidence collected through two rounds of implementation. It will report on the observed impacts and the process factors (barriers, facilitators, accelerators) that lead to impact identified after the implementation rounds.

In **part A**, the report focuses on the impact of COSMOS on the different stakeholders, (outcome evaluation), as well as various aspects of the implementation rounds (process evaluation). Specifically, our evaluation will focus on:

a. impact on school openness-level of the participating schools;
b. impact on learners' interest in science and science career aspirations;
c. impact on science teachers' SSIBL competences, and on their open schooling science teacher identities;
d. impact on stakeholders' open schooling collaborative skills and capacities to facilitate students' and citizens' educational engagement with SSI.

In **part B**, we use evidence collected throughout the COSMOS project to enrich the school openness model as proposed in the COSMOS conceptual framework (COSMOS, 2024). This involves the participating schools' practitioners' identified barriers and facilitators towards school openness. This section can inspire policymakers and practitioners to make a more outward movement as a school.

2. Part A – COSMOS Evaluation

2.1 Evaluation framework

We developed the COSMOS evaluation framework to specifically address the project's objectives, informed by a mixed-methods approach, with several distinct key areas of interest:

(a) ***School Openness***: impact of participation in COSMOS on schools' openness-level;
(b) ***Teachers***: impact of participation in COSMOS on (science) teachers' SSIBL competence and on their open schooling science teacher identity;
(c) ***Students***: impact of participation in COSMOS on students' interest in science, science career aspirations, and active/responsible citizenship.

2.1.1 School openness

To map the impact of the COSMOS implementation on the school openness of participating schools, we devised an ecological model of school openness that is composed of eight dimensions (Sarid et al., 2024). These eight dimensions are based on a conceptual analysis of various interrelated literatures: community-oriented open schooling discourse (e.g., Sotiriou et al, 2017; EC, 2024), the ecological model of school-as-community and community-oriented school leadership and governance (e.g., Furman 2002), learning communities, and communities of practice (e.g., Wenger, 1998), and open system theory (e.g., Mascareñaz & Tran, 2023). Below, we show a circular visualization of the eight dimensions (see Figure 5), organized into three distinctive categories: Organisation, Pedadogy and Community Relations (Sarid *et al.*, 2024).

Within the COSMOS evaluative framework, we consider three different levels of importance concerning school openness:

(a) The teacher level, at which an individual teacher determines his or her own position on the wheel, reflecting their own understanding of how open their teaching practice is;
(b) The science education level, at which a team of teachers (possibly including school leadership) identify how open the science education at their own school is;
(c) The school level, where a team maps openness at the level of the school as an organisation.

For more information about the ecological model of school openness - our conceptualisation of open schooling at the school organisational level – we to refer to the theoretical framework of COSMOS: WP2 – Framework (COSMOS, 2024) (Deliverable 2.1).

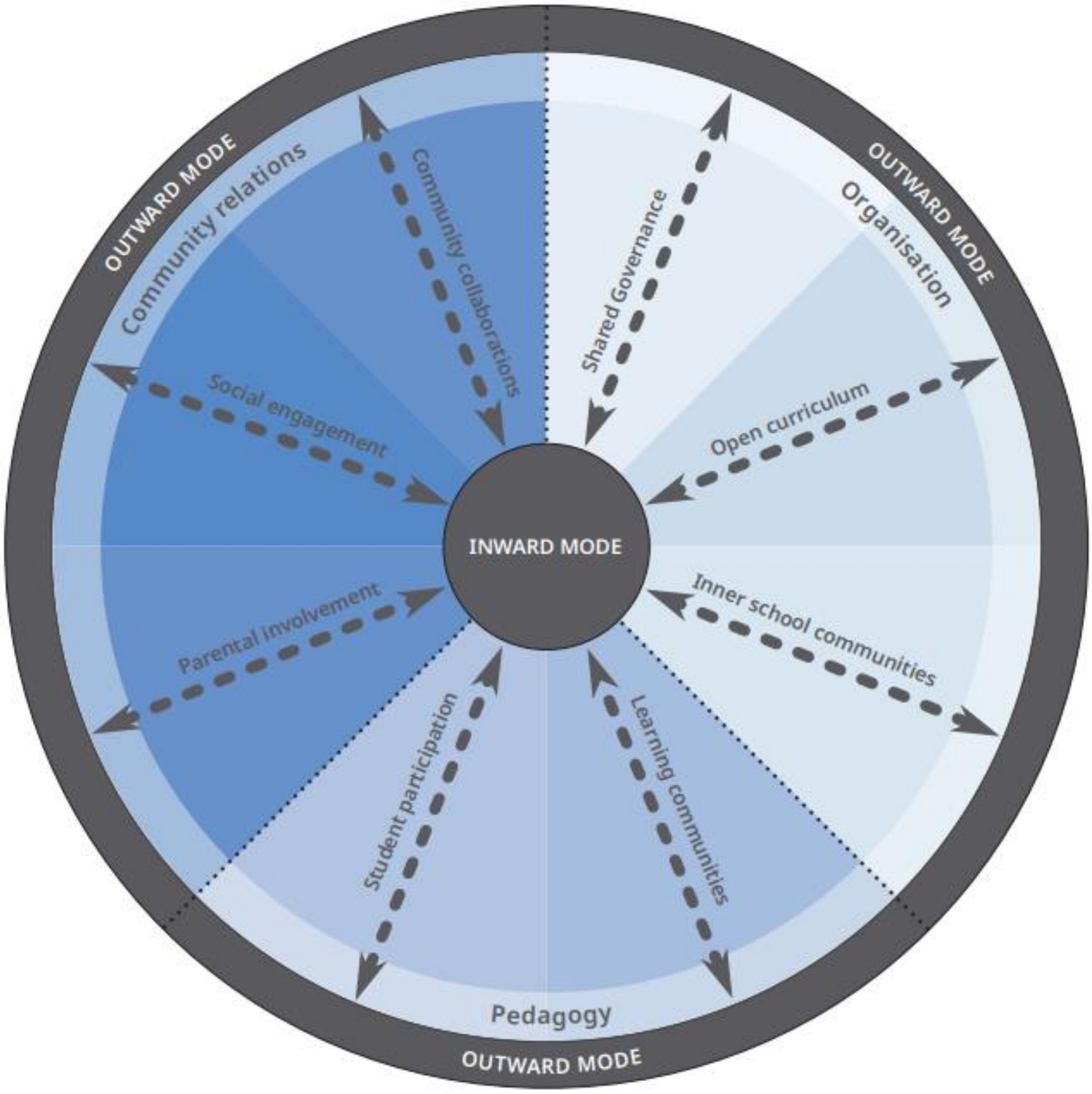

***Figure** 5.* Ecological model of school openness

2.1.2 Science teacher level

Embedding Socio-Scientific Inquiry-Based Learning (SSIBL) as a tool for opening up schools through science education requires the development of an open schooling science teacher identity. Such an identity will strengthen teachers' sense of belonging in the Communities of Practice, and their commitment to use SSIBL. This can provide affordances for the long-term sustainability of open schooling. A science teacher identity provides agency empowering teachers to teach science for active and responsible citizenship, and it can support them to overcome challenges previously identified when implementing SSIBL (Christodoulou & Grace, 2019; Knippels & van Harskamp, 2018).

To develop an open schooling teacher identity, we worked collaboratively with science teachers in safe contexts for reflection and action and supported them in creating and reflecting on experiences rich in open schooling identity resources (Avraamidou, 2014). This has been achieved using a range of Teacher Professional Development (TPD) activities in, and outside the school. Science teachers from participating schools took collaborative co-design and implementation of SSIBL lessons to develop their skills. This allowed science teachers to reflect on their role in the Community of Practice both as learners and educators. See the COSMOS Teacher Professional Development Handbook, D5.2 for more information.

Avraamidou (2020, p.324) defines science identity as the '*the perception of oneself as well as recognition by others as a science person*'. Teacher identity develops over time, it is fluid and involves the reconstruction of stories told over time (Buchanan, 2015) and so it is important to examine life histories in relation to science (Avraamidou, 2014), as well as the teachers' future selves, where they see themselves as science teachers in the future, which was explored through discussing the sustainability of the COSMOS approach with teachers and the extent to which they felt confident, prepared and willing to continue using the COSMOS approach (or variations of it) (See focus group at end of implementation Round 2). Identity is part of a teacher's personal resources (amongst others such as beliefs, orientations, knowledge), which influence their use of curricular materials, and teaching approach. Group membership is identified as an important dimension of forming teacher identity (Rushton & Reiss, 2020), this can be facilitated through the development of CORPOS and CoPs for open schooling.

In the COSMOS project, we are looking at what it means to become a 'SSIBL' teacher – not just someone that is able to use pedagogical skills required in SSIBL investigations but also someone that sees value in the key assumptions guiding the SSIBL pedagogy; i.e. teaching and learning science through authentic science practice; valuing the importance of action from learning, considering ethical, cultural dimensions of science knowledge and taking them into account, the importance of student voice, and listening to students, making their voices part of the teaching & learning process, to make science personally relevant to them, and their communities.

2.1.3 Student level

It has been described that applying open schooling can promote students' attitudes towards science, science career aspirations and active citizenship (Sotiriou & Cherouvis, 2017), especially toward addressing social-environmental issues. The COSMOS project provided rich opportunities to study such effects in diverse schools across Europe.

Science education for the 21st century, needs to consider not only how learning science can support functional scientific literacy through the use of science in everyday life (Vision II of science education, Roberts, 2006) but also move towards a more eco-reflexive perspective that focuses on learning both scientific knowledge and developing the competences required for critical-democratic and socially just participation in society (Sjöström & Eilks, 2018; Sjöström, 2024), that is Vision III of science education. By promoting scientific literacy and responsible citizenship, SSIBL aligns with such a demand for transformation of current science education. SSIBL bridges the gap between science education and societal needs and supports young people to develop and use the knowledge, skills and values needed to critically engage with global scientific and societal challenges such as the climate crisis and biodiversity loss in a socially just manner.

SSIBL's emphasis on learning science within socio-scientific contexts and for responsible and active citizenship, and its requirement for action as an inherent dimension of the learning process means that SSIBL is a pedagogy that can bridge Vision II and Vision III of science education, by enabling children and young people to critically engage with local, global and intercultural issues, understanding and appreciating different perspectives, interacting respectfully with others, and importantly, taking responsible action (Hodson, 2020; OECD, 2018). Therefore, SSIBL is well suited to pursue the ambitions set out by the European Commission for open schooling through science education to foster young people's interest and attitudes towards science and support the development of agency so that young people can be active and responsible citizens within their local communities and society (EC, 2015).

The students' learning outcomes were assessed by using two commonly applied approaches and validated quantitative measurement instruments: a modified version of the Pupils Attitudes Towards Technology (Ardies et al., 2014), in line with Vision II, and the Self-Perceived Action Competence in Sustainability (Olsson et al., 2020), in line for Vision III of science education.

Student outcomes in line with vision II of science education : science attitudes

The Pupils Attitudes Towards Technology/Science (PATT/PATS; Ardies et al., 2014) taps into the attitudes towards science and the science career aspirations of the students. The questionnaire is built on the six main latent categories of attitudes towards science: science career aspirations, interest in science, tediousness towards science, gendered view of science, relevance of science and difficulty of science. The COSMOS evaluative framework involves collecting evidence on the impact of schools' participation in the project on their students' attitudes towards science. To this extent, a mixed methodology (pre-post surveys supplemented with group interviews with students) provides insight into which of these six categories of students' attitudes are affected.

Student outcomes in line with vision II of science education : active citizenship

The Self-Perceived Action Competence Scale (SPACS; Olsson et al., 2020) taps into the active citizenship of the students. Action competence is a concept that has recently been revitalized in the context of learning for sustainability and citizenship (Sass et al., 2019), and that entails three main components. Firstly, it posits that in order to act towards a sustainable future, learners need relevant knowledge and skills of the action taking itself (knowledge of action possibilities). This goes beyond theoretical knowledge of issues or systems and puts applied knowledge of action taking in the forefront. Secondly, the action competence concept presents that learners need confidence in their own influence, or the belief that if they act it will produce favourable outcomes. This confidence in their own influence can be considered a feeling of 'what I/we do matters'. Finally, action competence has a third core component that is the willingness or drive/desire to act. This can be understood as strong motivation within learners to contribute to a more sustainable future through their individual, collective or political action taking.

By combining learning outcomes that are in line with both vision II and vision III of science education, the COSMOS evaluation framework takes a broad and inclusive approach, inviting in a wide arrange of learning outcomes that we seek evidence for in participating schools.

2.2 Evaluation & Monitoring in COSMOS

2.2.1 Evaluation questions

Through the COSMOS evaluative framework we seek to answer three driving evaluation questions (EQ) relating to the impact of COSMOS.

1. **Stakeholder Outcomes** (EQ1): What is the effect of COSMOS implementation on students, teachers, school organisation and other stakeholders?

2. **Pedagogical Processes** (EQ2): Which are the critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools?

3. **Organisational Processes** (EQ3): Which are the critical factors that facilitate or impede viable and sustainable CORPOSs in schools?

2.2.2 Evaluation framework

Evaluation data from diverse stakeholders involved (students, teachers, societal partners) were collected throughout both round of COSMOS implementation in participating schools. Figure 6 presented a summarize overview of data sources that were used to answer the evaluation questions.

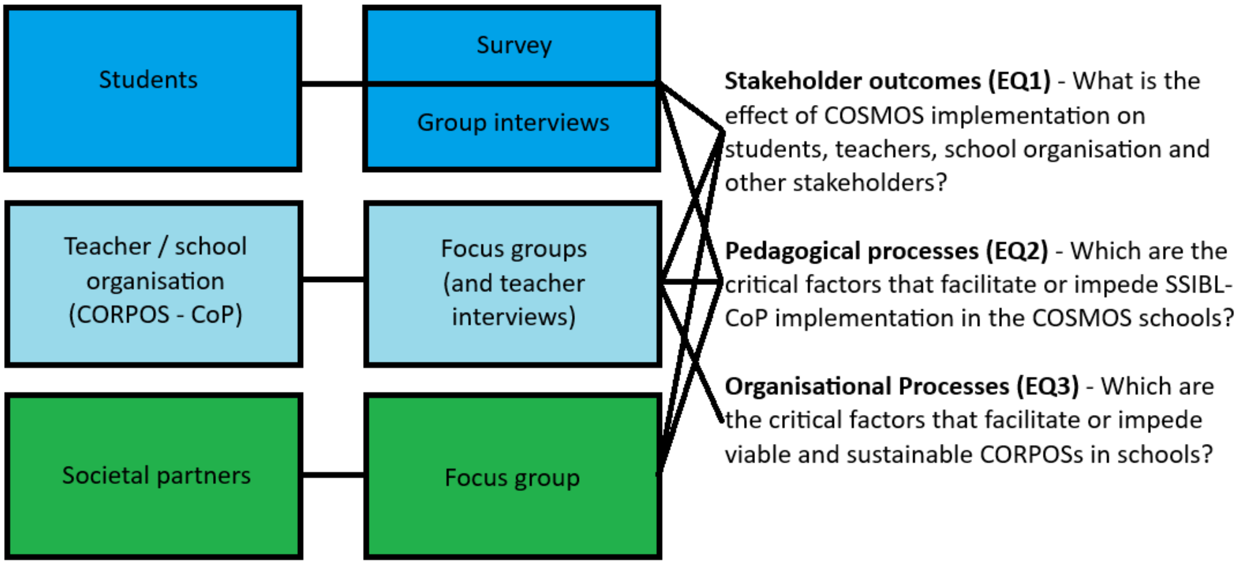

***Figure** 6.* COSMOS - Evaluation Framework

- Insights from **students** were collected through pre-post surveys to determine changes in interest in science, science career aspirations (vision II) and active citizenship (vision III). These quantitative data are supported by qualitative data collected using group interviews. These qualitative data provide information on the pedagogical process as well as its outcomes (EQ1-2).
- The **CORPOSs/CoPs** at each school were consulted to assess openness-levels during each of the initiation stages and at the end of the implementation rounds, through conducting focus groups with school staff and – where relevant - external key informants (CORPOS members & coaches from consortium HEI and societal partners; EQ2-3). The data from the focus group discussions were also used to determine teachers' pedagogical needs in relation to SSIBL-CoP implementation, as well as to monitor the process of teacher professional development, and SSIBL teacher identity development (EQ1-3).
- The **societal partners** that participated in the implementations at schools were also consulted with a focus on their role in the implementations and what they have learned themselves from this. The focus group with representatives from each societal partner provides qualitative data that gives insight into pedagogical processes as well as their outcomes (EQ1-2).

The evaluation framework was developed in an initial version during the first round of COSMOS implementations in schools and later developed iteratively into its final form. It is this final form that is presented in this report.

2.2.3 Evaluation toolbox

To streamline evaluation actions (data collection, analyses and interpretation) across the partners of COSMOS, a toolbox was developed. For each data source this toolbox presented partners with a manual to guide evaluation actions. The manuals are included as Appendices 1, 2 and 4 to this report together with the student survey itself (Appendix 3). A short overview of the most important elements is presented below, including a summary of the objective, timing and key practical information. Interested readers can consult the manuals in the appendices for more information.

The focus group that was performed with the societal partners did not require a manual as the partner in charge of the work package on evaluation coordinated this evaluation action. The focus group scheme can be found in Appendix 5.

Table 2. *Overview of manuals in the COSMOS Evaluation Toolbox, and their objectives and content*

Manual	Objectives	Content
1. CORPOS / CoP focus groups See Appendix 1	• Describe school openness at the start of the project • Guide setting goals for the CORPOS • Describe changes in openness and link these to COSMOS implementation • Determine barriers and facilitators to school openness • Determine barriers and facilitators to install viable and sustainable CORPOSs in schools • Catch the impact on science teachers' SSIBL competences, and on their open schooling science teacher identities • Determine critical factors that facilitate or impede SSIBL-CoP implementation	• Summary of objectives • Overview of timing • Overview of responsibilities • Practical guidelines • Data collection instructions • Focus group scheme • Supportive slides • Data analysis instructions • Codebooks for qualitative analysis • Data sharing instructions • Templates for sharing school results • Template for sharing country level results
2. Student surveys See Appendix 2	• Describe students' attitudes towards science and active citizenship at the start of implementation in schools • Describe students' attitudes towards science and active citizenship at the end of implementation in schools • Describe changes in students' attitudes towards science and active citizenship that can be attributed to COSMOS implementation	• Summary of objectives • Overview of timing • Overview of responsibilities • Practical guidelines • Data collection instructions, including links to online surveys • (Parental) consent procedure • Sample consent form and information letter • Sample communication for teachers
3. Student group interviews See Appendix 4	• Deepen understanding of student perspectives on learning in COSMOS implementations • Student reflections pedagogical processes leading to their learning	• Summary of objectives • Overview of timing • Overview of responsibilities • Practical guidelines • Interview scheme • Data analysis instructions • Codebooks for qualitative analysis • Data sharing instructions • Templates for sharing school results • Template for sharing country level results

2.2.4 Methodology

2.2.4a The evaluation process in COSMOS

The evaluation process – as for the whole COSMOS project - comprised a *preparation* stage, two *implementation rounds* and a *finalization* stage in which the evaluation report is written as you can see in Table 3.

The *preparation* stage focused on developing a COSMOS evaluation framework and assessment tools. Both *implementation rounds* had an *initiation* stage, focusing on determining the participating schools' current level of openness in the pre focus group, in order to set the baseline. In the *implementation* stage, we conducted the pre and post survey with the students, the differented group interviews with students, the post focus group and the focus group with the societal partners (only during implementation round 2). In the *finalization* stage we worked within the national and transnational teams analysing the data from the two implementation rounds and finalised the COSMOS evaluation report (D7.1).

***Table** 3.* Level, focus and timing of COSMOS evaluation

				When?							
		Why?		Round 1				Round 2			
		Outcome	Process	Initiation	Implementation			Initiation	Implementation		
Level	**What?**	EQ1	EQ 2-3		pre	during	post		pre	during	post
Students	Pre/post survey	X			X		X		X		X
	Group interviews	X	X		X		X				X
CORPOS	Focus groups	X	X	X			X	X*			X
CoP	Focus groups	X	X				X				X
Societal partners	Focus group	X	X								X

* not for continuing schools

2.2.4b Overview of participating schools – collected data

During the COSMOS project, 22 schools from six different countries participated in the evaluative part of the SSIBL-CoP implementation. Table 4 shows the COSMOS schools participating in (at least a part of) the evaluation of the project. All schools did not participate in each evaluation tool f.e. because of the age of the participating children younger dan 10 years.

for the survey.

***Table** 4.* Overview of participating schools COSMOS in (parts of) the evaluation

Country	**School**	**Level**	**Round 1**	**Round 2**
The Netherlands	School A	S	X	X
	School B	S		X
UK	School A	S		X
	School B	S	X	
Sweden	School A	S	X	X
	School B	P	X	
	School C	S		X
	School D	P		X
	School E	P		X
Portugal	School cluster A	P-S	X	X
Israel	School A	P	X	
	School B	S	X	
	School C	P	X	X
	School D	P	X	X
	School E	S		X
Belgium	School A	S	X	X
	School B	S	X	X
	School C	S	X	X
	School D	P		X

Table 5 summarizes the collected data for all countries for each level and each evaluation tool. All participating students were asked to fill in the survey. The student group interviews and focus groups were organized in each country at every school. Where schools implemented multiple projects in the context of COSMOS, a group interview was done with students from each of these projects.

***Table** 5.* Overview of collected data

		Implementation round 1						Implementation round 2					
Level	**Evaluation action**	**NL**	**UK**	**SW**	**PT**	**IS**	**BE**	**NL**	**UK**	**SW**	**PT**	**IS**	**BE**
Students	Pre survey	23	59	161	65	344	113	131	25	102	43	384	260
	Post survey	19	31	103	22	243	62	63	24	79	31	105	191
	Pre group interview	/	9	3	4	4	3	/	/	/	/	/	/
	Post group interview	5	9	3	3	4	3	11	17	3	10	3	3
CORPOS	Pre focus group	2	2	3	2	4	3	1	3	3	3	3	1
	Post focus group	1	2	2	2	4	3	2	3	3	3	3	3
CoP	Post focus group	1	2	2	2	/	3	2	3	3	3	3	3

2.2.4c General approach

COSMOS utilized a mixed methods approach answering the evaluation questions. The main methodologies applied are presented in section 2.3 and include both quantitative (students survey) and qualitative (interviews and focus groups) evaluation. A project wide approach was applied in which all data collection was coordinated by KdG and implemented by local HEI partners (see also section 2.3). As stipulated in the COSMOS data management plan, survey data was collected online through a system operated by KdG and analyzed centrally to produce project wide results. All qualitative data, on the other hand, was collected locally by COSMOS partners as well as analyzed locally. The results of these analyses were then shared through templates with the coordinator of the evaluation and processed to produce project wide results.

In the following sections relevant information on data collection and other methodological issues are presented and discussed in connection to the specific evaluation question and target group.

2.3 Findings

2.3.1 Stakeholder outcomes

2.3.1.1 The effect of COSMOS implementation on students

a) Questions asked to answer through student data

Student data collection from students' participation on the different implementations in each of countries in the COSMOS project, both quantitative and qualitative, was strategically aimed at answering five questions. Together, they allow us to present a nuanced overview of the impact COSMOS has had on the students. It is important to note here that the focus within this report lies not on comparing countries of different implementations to each other. Rather the focus goes to presenting evidence if and how the COSMOS project contributes to students' attitudes toward science and action competence in general. The driving questions for this section of the evaluation are:

(1) Does participating in COSMOS **contribute** to students' attitudes towards science and action competence for sustainable development?

- From a *qualitative perspective*, this question is to be understood as the students' own post-implementation reflection on the contribution of COSMOS to their attitudes towards science and action competence.
- From a *quantitative perspective*, this question should be understood as differences in scores of the students' answers to survey questions (relating to attitudes towards science and action competence) that are asked before and after the implementations.

(2) Are the observed effects of COSMOS on students' attitudes towards science and action competence for sustainable development the same for both **implementation rounds**?

- This question explores if the effects that we observe for both implementation rounds are similar and whether the second implementation round might reflect different learning outcomes that could be associated to shifts in the implementation process at project level.

(3) Do we observe meaningful **differences** in effects of COSMOS on students' attitudes towards science and action competence for sustainable development **across the schools** in the project?

- While not interested in comparing specific schools for the current evaluation report, with answering this question we get more information on whether or not the effect of COSMOS on COSMOS on students' attitudes towards science and action competence can be considered something that rather general for all schools in the project than school specific or vice versa.

(4) Are the observed effects of COSMOS on students' attitudes towards science and action competence for sustainable development different for **educational levels**?

- Again, while not interested in comparing specific schools for the current evaluation report, we do want to explore if our approach yield different results in primary and in secondary schools.

(5) Are the observed effects of COSMOS on students' attitudes towards science and action competence for sustainable development different for **genders**?

- As has been described in literature students that identify and male or female can hold different science attitudes and action competence. While we are not interested, in this evaluation report, to compare students based on their gender in terms of their science attitudes and action competence, we do want to acknowledge that the

COSMOS approach might impact student identifying with different genders differently. Therefore, comparing the effect of COSMOS on boys and girls allows us to reflect on a possible gender specificity in our approach.

The table below (Table 6) present a brief overview of the data sources that were used to answer each of the questions above. As can be seen from this overview, the quantitative data allow to answer each of the questions, and the qualitative data allows to add insight on the overall effect of COSMOS through student voice, as well as for differences between students in primary and secondary education. More information on data collection, data analyses and finding follows after this overview.

***Table** 6.* Overview of questions answered through student data

Focus		Surveys	Group interviews
1	Overall effect of COSMOS on student outcomes	X	X
2	Differences in effect between implementation rounds	X	
3	Do we observe meaningful differences in effects of COSMOS between schools (primary/secondary) and genders?	X	X

b) Data collection procedure

The effect of COSMOS implementation on participating students was evaluated through mixed methods data collection. We organized a **student survey** to collect quantitative data on their attitudes towards science and action competence, as well as **student group interviews** with selected students from each implementation in the different schools. Data collection for the **student surveys** was coordinated locally by each higher education partner. In each implementation round, the survey was administered to participating children twice: once before the start of the COSMOS implementation (t1) and then once more within two weeks after the teachers involved considered their schools' implementation as finished (t2). This procedure allowed for flexible planning attuned to the specific situation within each school.

The surveys were hosted in an online system operated by KdG. We had seven versions of the survey: Dutch (Flemish), Dutch (The Netherlands), Portuguese, Arab, Hebrew, Swedish and English. Students could select their language at the start of the survey. Where relevant, they also had the option to pick the English version of the survey, e.g. if they were international students or if they felt didn't master the language of instruction enough. COSMOS partners arranged the practical issue around the data collection with each school individually to match their needs. This results in a differentiated approach where in some schools a researcher was present at the time of the administration (to support the teacher, or to coordinate the collection), while at others the teacher received instructions and supervised the collection themselves. In a few cases, mainly in primary schools, the teachers opted for a pen-and-paper administration. These schools were provided with paper versions of the surveys, which were then later digitized by the researchers at the local COSMOS partner. Completing the surveys online took the students on average 12,5 minutes (SD = 4.1 minutes).

Student group interviews used for answering the questions about the effect COSMOS implementation were organized within two weeks after the teachers considered the implementation as finished. Interviews with students were always conducted in their language of instruction at the school. The interviews were audio-recorded and then transcribed verbatim at the researcher's earliest convenience. In line with ethical clearance, once transcribed the audio-recordings were deleted. Interviews lasted about 30-45 minutes depending on local issues and happened in person at the school.

c) Participants

The participants in the **student surveys** are those students for whom we obtained consent, and where relevant parental consent, to complete the survey and share their data with us. The ages of consent depended on local conditions, and we followed local regulations in line with ethical clearance obtained from each partners' ethics board. In total for both implementation rounds, 1667 students participated at t1, and 995 at t2 of the survey. In line with the ethics approvals obtained nationally, students generated a personal identifier that allowed to connect data from the same students at t1 and t2. We were able to match 562 students across t1 and t2. Table 7 presents an overview of the entire sample of data collected within COSMOS through the student surveys. The age of the students across the whole sample ranged between 9 and 21 years (M = 13,16, SD = 2.74). This corresponds to participating students' grade spanning grades 5 through 12. Students that were younger (e.g. in grades below grade 5) were not included in the survey as their reading proficiency was considered not developed enough to respond to the statements. Generally, it can be stated that students above the age of 16 could give consent themselves, and students between the ages of 10 and 16 give consent together with a parent or legal guardian. 47.3% of participants identified as female, 49.4% identified as male, 0.5% identified as non-binary, and 2.9% preferred not to disclose their gender identification.

The **student group interviews** were organized in each country at every school. Where schools implemented multiple projects in the context of COSMOS, an interview was done with students from each of these. This report contains only the data from the group interviews of the second implementation round. In between the first and second implementation round adaptations were made to the interview guide in order to correctly answer the evaluation questions. In total 20 group interviews took place across all participating schools in the different countries. Ten group interviews were held in primary schools and ten in secondary schools. In each group interview, at least three students participated to reflect on their learning through COSMOS.

d) Focus of the data collection

The **student survey** included several parts. In the first part we asked the students to confirm their consent and generate their personal identifier. This was done through providing the first two digits of their surname, the first two digits of their mother's first name and the month they were born in. Based on these 6 digits, we could compose a unique code for each student. Next, the survey inquired about the students' age, gender and school. Depending on the ethical clearance, students were able to pick their school from a list that was predefined by the COSMOS team, or they were invited to write the name of the school as an answer to an open question (Sweden, United Kingdom). After these background variables, the survey included Likert-type statements tapping into the students' attitudes towards science and action competence. For these, we use the operationalizations as developed in earlier research.

The **Pupils Attitudes Towards Technology/Science** Questionnaire (PATT/PATS; Ardies et al., 2014) provides insight into which of these six categories of students' attitudes are affected. Each of these subscales is measured through at least three items on a 5-point Likert-type scale (1=strongly disagree, 5=strongly agree, with a neutral option in the middle). Students were not given an answer option 'I don't know', but after each items batch for a subscale, they were invited to add anything they felt relevant in open questions in the survey. Table 8 shows all sub-scales of the PATS survey and for each of them a sample item. Based on the data collected within COSMOS, the reliability of these subscale ranges showed to be high to excellent, with Cronbach alpha values ranging between .75 and .95.

Table 7. Overview of the sample of participants in the COSMOS student survey in each country

Country	School	Level	Round 1			Round 2			Total		
			pre	post	paired	pre	post	paired	pre	post	paired
The Netherlands	School A	S	22	18	11	91	63	42	153	81	53
	School B	S				40					
UK	School A	S				25	24	19	73	49	37
	School B	S	48	25	18						
Sweden	School A	S	62	50	31	14			267	229	170
	School B	P	103	100	79						
	School C	S				35	22	13			
	School D	P				24	26	21			
	School E	P				29	31	26			
Portugal	School cluster A	P-S	57	22	18	43	31	19	100	53	37
Israel	School A	P	43	34	21				705	334	140
	School B	S	64	44	23						
	School C	P	174	109	70	151	105	30			
	School D	P	40	42	26	134					
	School E	S				99					
Belgium	School A	S	32	15	2	71	53	19	369	249	125
	School B	S	45	9		111	60	27			
	School C	S	32	34	22	31	30	20			
	School D	P				47	48	35			
Totals			722	502	321	945	493	241	1667	995	562

Table 8. The sub-scales of the Pupils Attitudes Towards Science (PATS), and sample items

Subscale (#items)	α	Sample item
Science career aspirations (4)	.92	A career in science would be interesting for me
Interest in science (6)	.75	Science lessons are important
Tediousness towards science (3)	.81	Most jobs in science are boring
Gendered views of science (3)	.95	Boys are better at science than girls
Relevance of science (4)	.87	Science can help improve our lives
Difficulty of science (4)	.79	You have to be smart to study science

The **Self-Perceived Action Competence Questionnaire** (SPACS; Olsson et al., 2020) is built on the three main latent categories of interconnected outcomes of action competence: knowledge of action possibilities, confidence in own influences and the willingness to act. Each of these subscales is measured through four items on a 5-point Likert-type scale (1=strongly disagree, 5=strongly agree, with a neutral option in the middle). Students were not given an answer option 'I don't know', but after each items batch for a subscale, they were invited to add anything they felt relevant in open questions in the survey. Table 9 shows all sub-scales of the SPACS survey and for each of them a sample item. Based on the data collected within COSMOS, the reliability of these subscale range showed to be high to excellent, with Cronbach alpha values ranging between .85 and .90.

Table 9. The items and sub-scales of the self-perceived action competence for sustainability (SPACS)

Subscale (#items)	α	Sample item
Knowledge of action possibilities (4)	.85	I know how one should take action at school in order to contribute to sustainable development
Confidence in own influences (4)	.87	I believe I have good opportunities to participate in influencing our shared future
Willingness to act (4)	.90	I want to engage in changing society towards sustainable development

The **student group interviews** consisted of a semi-structured group interview focusing on the perceived attitudes towards science and the action competence of the students, in the interview after each of the implementation rounds. Students also reflected on if and how the COSMOS project contributed to these outcomes. At the beginning of each implementation round parents – if required – gave their consent for their children to participate in this group interviews. We asked for the students' consent right before the group interview. The students were selected on a voluntary basis. As much as possible - during the first implementation round – we interviewed the same students for the pre as for the post group interview.

The scheme of the semi-structured group interview can be found in Appendix 3. This was developed iteratively throughout the project with the focus and approach shifting along with developing project needs within COSMOS. What remained present in each data administration using the schemes was the focus on learning outcomes in terms of PATS and SPACS, and COSMOS' contribution to these.

e) Analytical procedure

For answering each of the questions addressed in this section, we selected an appropriate data analysis technique for the **student survey data**. A first step was to clean the survey data, removing students that had completed the survey in within a time that identified them as an outlier based on the lower threshold 95% confidence interval for a normal distribution of the variable the provided information on how fast they completed the survey. In our specific case that identified all student who took under 4.3 minutes to finish the survey. The upper threshold for the confidence interval was not used to identify and remove outliers as students were technically allowed to pause the survey and continue at a later point. Longer time taken therefore does not indicate a problematic outlier.

Students who, upon visual inspection of that data, answered the same value to each question, or who answered through pattern no reflecting authentic reactions, were also removed. Next, based on their personal identifier, student data was matched between t1 and t2, allowing us to do more powerful analyses through paired data. These procedures resulted in 562 students in 17 schools (see also table 7 in section c, above). Using these data, the five questions that we aimed to address were answered through the analytical technique presented in the overview in table 10. To estimate effect sizes, we calculated Cohen's d, which allows us to label effect as small ($0.2 < d < 0.5$), medium ($0.5 < d < 0.8$) or large ($0.8 < d$).

The **student group interviews** were thematically analyzed through a mixed inductive and deductive procedure by researchers within each of the national contexts. To structure the coding process we used the subscales of the Pupils Attitudes Towards Technology/Science Questionnaire (PATT/PATS; Ardies et al., 2014) and the Self-Perceived Action Competence Questionnaire (SPACS; Olsson et al., 2020). The procedure was guided by a manual for evaluators to streamline the process and support reliability and validity of the data. The analysis started at implementation level, meaning that for each COSMOS implementation in each school a template was filled in that categorized students' account of learning through COSMOS in terms of attitudes towards science and action competence, and finally also 'other learning outcomes'. Afterwards the information collected in these implementation level templates was aggregated into country level reports which were then shared with the team coordinating the evaluation work for COSMOS. The manual and templates for evaluators can be found in Appendix 4. In this current report we present findings that come from aggregation of the country-specific results into a project-wide overview.

As with the quantitative analyses presented above, the insights learned from the qualitative analyses are intended to contribute to our understanding of the impact COSMOS has had on students across the board. While the data we have collected with the consortium can be used to look into specific outcomes of specific interventions, the current report only addresses the project wide levels.

***Table** 10.* Questions into effects of COSMOS on students, and the analytical techniques used to answer them

Focus		Analytical technique
1	Overall effect of COSMOS on student outcomes	Paired t-test with all data, for all dependent variables, from students that could be matched between t1 and t2.
2	Differences in effect between implementation rounds	Paired t-test with all data, for all dependent variables, from students that could be matched between t1 and t2, for implementation round 1 and implementation round 2 separately.
3	Are observed effects school general or school specific?	Differences in scores between t1 and t2 data for each of the dependent variables, with schools as predictor in ANOVA.
4	Are observed effects different for educational levels?	Differences in scores between t1 and t2 data for each of the dependent variables, with level and gender as predictor in t-test.
5	Are observed effects different for genders?	

f) Results and interpretations

In the section we will address each of the three questions into the effects of COSMOS on participating students using results from relevant quantitative and qualitative analyses.

(1) Does participating in COSMOS contribute to students' attitudes towards science and action competence for sustainable development?

A paired t-test for all t1 and t2 data in round1 and round 2 for students we were able to match, was used to explore the overall effect of COSMOS on students' outcomes. Below we first present the results COSMOS has had in terms of **students' attitudes towards science**. This includes analyses for all six subconstruct of the PATS survey. Table 11 shows an overview for each of the PATS subconstructs, and their mean and standard deviation at t1 and t2 across both implementation rounds, the difference in the mean values, the test value for their paired t-test, the associated p-value indicating statistical significance, and the effect size in terms of Cohen's d.

Mean values and standard deviations should be interpreted in light of the 5-point Likert scale with which the data was administered. This implies that the mean values can range between 1 and 5 from totally disagreeing to totally agreeing with the items the underlie the scales, and that 3 can be considered a neutral value.

The results in table 11 show that students' participating in COSMOS implementations at their schools, be it in round 1 or round 2 and be it in primary or secondary schools, report a statistically significant increase in their interest in science as well as in their perception of science as relevant. Cohen's *d*-values for these two variables point towards a medium effect size for interest and small effect size for relevance. For the others subconstructs, the analyses don't show an overall effect of COSMOS in student attitudes. Figure 7 presents these results visually.

***Table** 11*. Results of paired t-test for all PATS constructs for both implementation rounds combined (n=562)

Science attitudes	pre *M ± SD*	post *M ± SD*	t2-t1 *M*	*t*	*p*	*d*
Career aspirations	2,61 ± 1,16	2,65 ± 1.22	0,04	0,85	0,396	n/a
Science is interesting	2,92 ± 0,83	3,18 ± 0,78	0,26	9,30	<0,001	0,59
Science is boring	2,24 ± 1,06	2,18 ± 1,06	-0,06	-1,41	0,159	n/a
Science is for boys	1,61 ± 1,08	1,65 ± 1,04	0,04	1,13	0,258	n/a
Science is relevant	3,36 ± 1,01	3,58 ± 0,98	0,22	5,95	<0,001	0,25
Science is difficult	2,29 ± 0,74	2,30 ± 0,73	0,01	-0,24	0,812	n/a

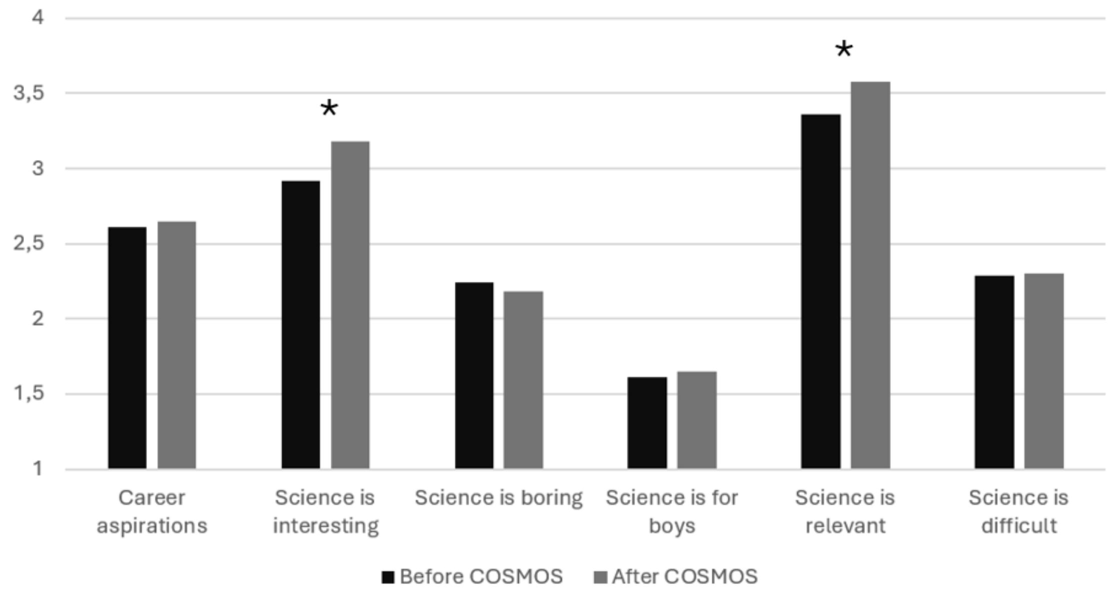

***Figure** 7*. Pre and post mean values for all subconstructs of the PATS survey.
** Marks significant differences*

While the results of the quantitative analyses provide a general overview of the effect participating in COSMOS has had on students' attitudes towards science, we find additional evidence in the results of the group interviews that were held with selected students from the different implementations. Table 12 below presents a high-level overview of insight that can be drawn from the thematic analyses and aggregation procedure of the conversations held with groups of students in COSMOS. Where relevant, the table includes illustrations using quotes from students.

***Table** 12.* Overview of high-level insights from student group interviews in terms of COSMOS' contribution to their science attitudes

Subtopic	Insights at aggregated project level
Science career aspirations	Upper secondary students indicated that the SSIBL-CoP implementation(s) gave them a better insight into the profession of a scientist (e.g. what are steps in scientific research process) and some even reported a small positive effect on their science career aspirations due to their participation in COSMOS. *'Well, I don't think I'd want to become it [scientist], but I do think, say if I wanted to become it, I'm excited now because of the project, that you do just also understand a bit more actually what you have to do as a researcher, what exactly the profession is.'* (N2B) The lower-secondary students and primary students mainly indicated that it had broadened their view on science, but it was too early to think about a science career. *'It's too early to think about that, I haven't seen enough to appreciate it enough' (N2A)*
Science is interesting	From students' own perspective, the COSMOS project increased students' interest and enthusiasm for science, highlighting its practical applications and the importance of continuous learning. Secondary students, as well as primary students, showed particular interest in interactive and practical activities inside and outside the school. *"I really enjoyed understanding things that I didn't know so much about, bees, that they play such an important role and that they are so special..." (I1D)*
Science is boring	In two of the participating schools – United Kingdom and the Netherlands - no comments about science being boring have been found in the interviews. In all other countries students agreed on the fact that the COSMOS approach made science lessons less boring to them.
Science is for boys	Across all schools and all countries, no student mentioned during the group interviews any change towards their gendered view of science.
Science is relevant	Through the eyes of the students, the COSMOS project emphasized the importance of science for the future, particularly in addressing sustainability and climate change. Students recognized the practical applications of scientific knowledge in solving real-world problems and making informed decisions, thereby enhancing their understanding and appreciation of science. *"Yeah, because if you don't know how the Earth works you don't know how to think about the issues. So like say around like climate change, if you don't know about like the greenhouse effect then you don't know how to fix it. So it's good like to give people information so then they hopefully tell people to fix the problem themselves." (U2D)*

	Some of the students do not see connections in between their science lessons and everyday life (as opposed to when we are talking about science in general), although they do identify and raise the connection of their science lessons to talking more about the world's problem, which directly links to the SSIBL-CoP implementation they experienced. *"I think it's connected to everyday life by talking more about, like, the world's problems and how science can help us fix them, like waste and stuff, like talk more about what actually needs to be changed and how we can change it... I don't think you can see it, but it should be, like, linked to the real world more, like, we should learn more about the problems that are in the world and how science can help us solve them, instead of just, like, learning stuff out of a book." (U1B)*
Science is difficult	Some interviewed students did not find science subjects hard but recognize that peers find science difficult and suggested the SSIBL-CoP as a solution for it. *'Many people find science subjects abstract and don't quite get it. This [COSMOS approach] does show clearly how it is also in your everyday life and the fact that you also had free choice in the research questions also shows again, say that you can put your own spin on it. For example.'* (N2B) Students shared the SSIBL-CoP implementation presented some challenges for them, particularly in constructing models, coordinating with team members, formulating adequate questions and daring to pose questions to strangers. *'I found the interview part difficult, because it is awkward to ask people on the street to interview them.' (N2A)*

Similar analyses were performed to address COSMOS' overall impact in participating **students' action competence for sustainable development**. The Table 13 and Figure 8 present the results of these analyses. The results indicate small (both $0.2 < d < 0,5$) but statistically significant (both $p < 0.001$) effects on students' confidence in their own influence to contribute to more sustainable future as well as their willingness to act. Looking at the mean values of these two variables, it can be seen that both evolve from a value below the neutral mean of 3,00 to a value above this. So, given the effects sizes are small they do include an evolution from rather no agreeing to items relating to confidence in own influence and willingness to act to rather agreeing with them.

While the results of the quantitative analyses provide a general overview of the effect participating in COSMOS has had on students' action competence, we also find additional evidence in the results of the group interviews that were held with selected students from the different implementations. Table 14 below presents a high-level overview of insight that can be drawn from the thematic analyses and aggregation procedure of the conversations held with group or students in COSMOS. Where relevant, the table includes illustrations using quotes from students.

***Table** 13.* Results of paired t-test for all SPACS constructs for both implementation rounds combined (n=562).

Action competence for sustainable development	**pre** *M ± SD*	**post** *M ± SD*	**t2-t1** *M*	***t***	***p***	***d***
Knowledge of action possibilities	3,36 ± 0,96	3,40 ± 0,92	0,04	1,04	0,300	n/a
Confidence in own influence	2,88 ± 1,05	3,13 ± 0,99	0,25	5,44	<0,001	0,23
Willingness to act	2,95 ± 1,02	3,18 ± 1,12	0,23	5,45	<0,001	0,31

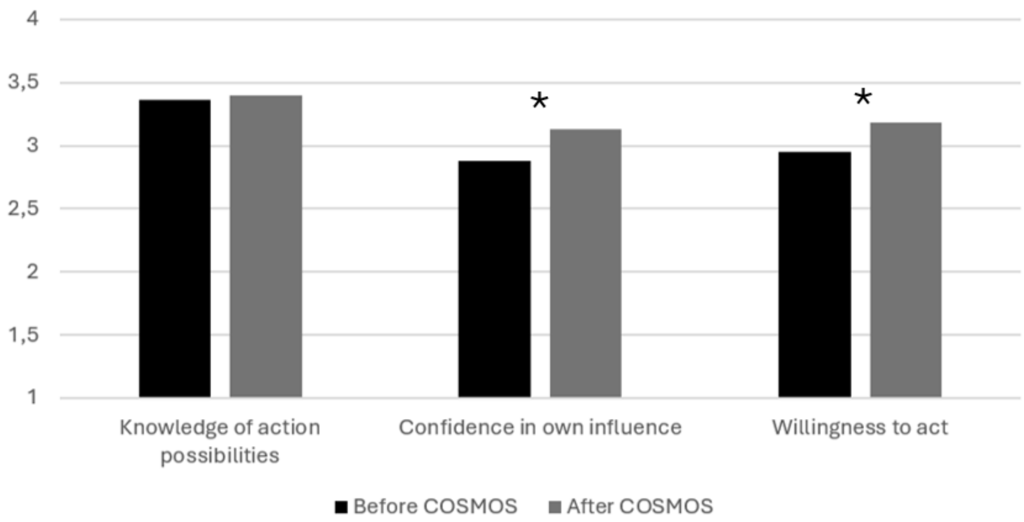

***Figure** 8.* Pre and post mean values for all subconstructs of the SPACS survey.
** marks significant differences*

***Table** 14.* Overview of high-level insights from student group interviews in terms of contribution to their action competence.

Subtopic	Insights at aggregated project level
Knowledge of action possibilities	The students talked about the COSMOS project significantly enhancing their knowledge of sustainable practices and the potential for practical actions to improve sustainability in their environments. *"You can make jams from excess fruit that is not rotten; like using dried bread to make croutons. Surplus fruits can be supplied to factories or small businesses that produce confitures; We can explain to the 7th graders different options for using fresh foods that don't look so good. The project opened up my eyes to this" (I2E)* Most students' answers reflected some insight into the complexity of the issue and they also had ideas and knowledge on how to approach/ solve the issue. While some students indicated they didn't find the issue a great problem at all. There are indications that students are aware of action possibilities on more concrete issues in their environment such as making the school more sustainable but also on a more global scale such as climate change. *'Yes, I do indeed think it* [ref. to climate change] *is a big and also acute problem. And yes, well, I do think that it is also a big thing, that we have to learn to live with it a little bit, because you can't go back to how it was [...] And yes, I do also think in itself that there are solutions that will make it less, but I don't think that this will, say, get a whole lot better again, that it will be solved completely. [...] I also think of: yes, you can't improve it much further, but you can prevent it from getting worse, I think. I think that's possible. [...] And yes, it's just a combination. It's science, ordinary people, the government I think, everyone has to do it together to really stop it.' (N2B)*
Confidence in own influences	Regarding the confidence in their own influences, the opinions are differentiated. For some students the COSMOS project empowered them to believe in their capacity to influence positive outcomes on socio-scientific issues. *"We learned about food waste- why it happens and how much, its ecological footprint. After we had some lessons on this, I discussed with my mother how we can change our food purchasing so that we buy what we need and don't throw away unused food. I really think that we saved ourselves money, and also the world ... I've made my change – I'm more involved in my family's supermarket, for me this is a victory because I saved us a lot in terms of food that we throw away and that we buy" (I2E)* Other students do not believe that they have a lot of influence in changing the world for good. They felt that they were never really listened to or were very aware of the complexity of the issue, e.g., that more people need to be willing to act or change to solve the issue.

	"We have tried to make the food better here at the school through the student council, but they don't listen to us. No changes have ever happened" (S1B) *'Yes, that yes, even though as one person I may have less impact. Now, it's still an impact. If many people do it together, it has a lot of impact. I think every person who can do something for the climate, I think they do. A government of that big Shell or something, they have much, much more impact, but I also just have impact.'* (N2B)
Willingness to act	Different students participating in COSMOS project note willingness to act at an individual level when discussing what they would like the world to be and how they can make that happen. *'Yes. Yes, I do think that I am now at least a little bit aware of what I do, less likely to shower longer, things like that, think about the climate a little bit myself .' (N2B)*

(2) Are the observed effects of COSMOS on students' attitudes towards science and action competence for sustainable development the same for both implementation rounds?

The above results reflect the overall effects of COSMOS across both implementation rounds in the project. As these rounds were not just repetitions but rather reflect changes in priorities and strategies in which the COSMOS consortium worked with the schools, we here also present the results for each implementation round separately. More details on the projects that were implemented in both rounds, as well as the changes that were implemented project wide in the implementation rounds can be found in deliverables Deliverable 3.2 and Deliverable 4.2, which respectively focus on the implementations in primary and secondary schools.

For all dependent variables, relating both to attitudes towards science as well as action competence for sustainability, the below tables and figure show the results for implementation round 1 and implementation round 2. Overall, it can be seen that the results that are found for the general data set are similar to those for implementation round 1: a medium effect size (d = 0.59) for interest in science, and small effect sizes (d ≤ 0,25) for relevance of science, confidence in own influence and willingness to act. For the second implementation round, the results suggest a similar pattern but also include a small effect size (*d* = 0,23) for knowledge of action possibilities, as well as a very small but statistically significant decrease in the participating students from this cohort's perceptions of science a boring school subject.

These results suggest that the impact of COSMOS has been consistent, and that the adaptations made at project level to the implementation strategies have broadened the impact of COSMOS of the students to include more diverse and positive effects as the project moved from its first implementation round to its second implementation round, in which lessons learned had been integrated.

Interestingly the group of students that participated (across all schools) in implementation round 2 shows a lower starting value for interest in science (*M* = 3,28 for round 1 and *M* = 2,44 for round 2) yet the effect of participating in COSMOS is similar for both cohorts: and increase with an effect size (*d*) of 0,59 and ,58 respectively suggesting that also for less interested cohorts, the open schooling approach applied to science education in the COSMOS project can contribute to development of students.

***Table** 15.* Pre-post comparison of all student outcomes using paired data from implementation round 1 only (n=322).

Implementation round 1 – School year 2022-2023						
Scale	pre *M ± SD*	post *M ± SD*	t2-t1 *M*	*t*	*p*	*d*
Career aspirations	2,68 ± 1,19	2,75 ± 1,28	0,07	1,30	0,193	n/a
Science is interesting	3,28 ± 0,85	3,49 ± 0,82	0,21	5,28	<0,001	0,59
Science is boring	2,23 ± 1,13	2,22 ±1,10	-0,01	-0,88	0,930	n/a
Science is for boys	1,64 ± 1,13	1,69 ± 1,05	0,05	0,96	0,337	n/a
Science is relevant	3,43 ± 1,10	3,68 ± 1,01	0,25	4,58	<0,001	0,25
Science is difficult	2,22 ± 0,76	2,25 ± ,075	0,03	0,83	0,204	n/a
Knowledge of action possibilities	3,39 ± 1,08	3,34 ± 1,01	-0,05	-0,72	0,236	n/a
Confidence in own influence	2,93 ± 1,13	3,20 ± 1,06	0,27	4,01	<0,001	0,23
Willingness to act	2,93 ± 1,08	3,17 ± 1,18	0,24	4,01	<0,001	0,23

***Table** 16.* Pre-post comparison of all student outcomes using paired data from implementation round 2 only (n=242).

Implementation round 2 – School year 2023-2024						
Scale	pre *M ± SD*	post *M ± SD*	t2-t1 *M*	*t*	*p*	*d*
Career aspirations	2,53 ± 1,11	2,51 ± 1,11	-0,02	-0,41	0,682	n/a
Science is interesting	2,44 ± 0,50	2,77 ± 0,49	0,33	8,66	<0,001	0,58
Science is boring	2,26 ± 0,97	2,14 ± 1,01	-0,12	- 2,25	0,025	0,14
Science is for boys	1,56 ± 1,00	1,60 ± 1,02	0,04	,62	0,533	n/a
Science is relevant	3,27 ± 0,86	3,45 ± 0,91	0,18	3,92	<0.001	0,25
Science is difficult	2,39 ± 0,72	2,36 ± 0,71	-0,03	0,68	0,492	n/a
Knowledge of action possibilities	3,31 ± 0,77	3,47 ± 0,79	0,16	3,20	0,002	0,20
Confidence in own influence	2,80 ± 0,95	3,02 ± 0,88	0,22	3,64	<0.001	0,23
Willingness to act	2,99 ± 0,93	3,20 ± 1,04	0,21	3,64	<0.001	0,23

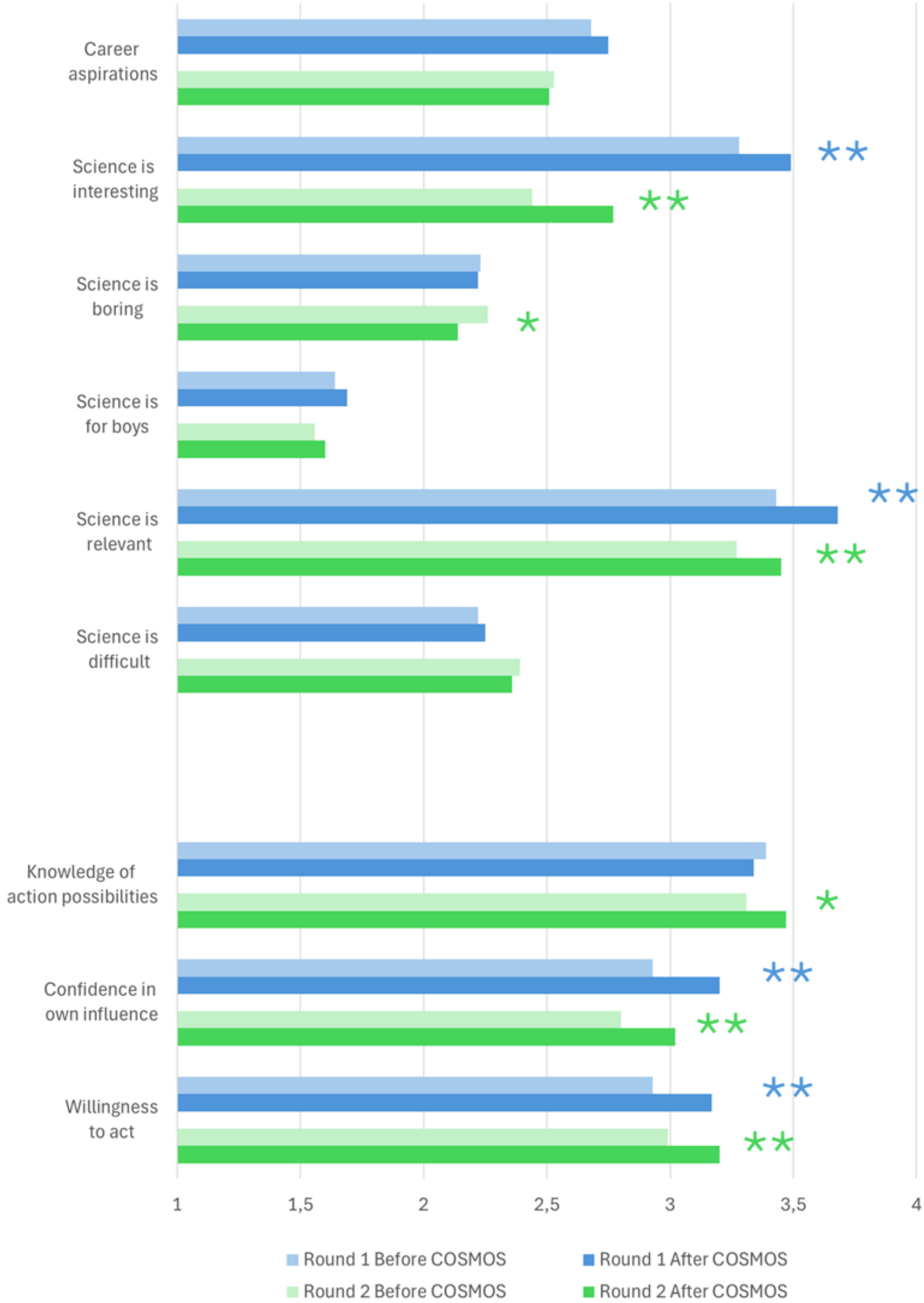

Figure *9.* Summary of comparison for each of the students' science attitudes and action competence toward sustainability before and after participation in round 1 and round 2 of COSMOS.
** marks p<0.05, ** marks p<0.001*

(3) How universal is COSMOS in producing these outcomes? Do we observe meaningful **differences** in effects of COSMOS on students' attitudes towards science and action competence **relevant variables**?

All results above can be considered project-wide in the sense that they include all participants from all schools. As such they present a high-level overview of the COSMOS project on students in the participating schools. There are several ways to go beyond this high-level nature of the results, e.g. by exploring results for each school specifically. For the purposes of the current evaluation report such detail is beyond scope, yet several questions that address the specificity versus universalism of the results are warranted. In this section we explore three such avenues:

- School specificity: Do we have indications from our data that there are meaningful differences in the effects of COSMOS among students from different schools? In other words, how school specific versus school independent can we consider the COSMOS approach to be?
- Educational level specificity: Do we have indications from our data that the COSMOS approach is more or less effective in the primary versus in the secondary schools that participated?
- Gender specificity: Do we have indications from our data that the COSMOS approach is more or less effective for boys and compared to girls?

Before going into possible differences in the effect of COSMOS for these three questions, we present descriptive statistics for all independent variables relating to science attitudes and action competence for students from primary and secondary education and for boys and girls separately. These descriptives are based on data we collected at t1 in all schools in both implementation rounds, regardless of the fact if we were able to match them to data from t2. In this way they present an overview of the starting position of the students we worked with in both cohorts.

Table 17 and 18, as well as figures 10 and 11, show significant and meaningful differences in the science attitudes and action competence of students at t1 within our sample of students in COSMOS schools. They highlight e.g. that students in secondary education hold significantly lower science career aspirations than students in primary schools (d=-0,384), and that girls significantly less adhere to gendered attitudes of science than boys (d=-0,890). While interesting to explore further, for the purpose of the current evaluation report we do not go deep into explaining these differences.

We do want to acknowledge that these differences exist, as they might create a context to interpret the possibly different effectiveness of the COSMOS approach to open schooling on students from different educational levels and/or different genders. Therefore, we sketch relevant differences among educational levels and genders but focus our main attention to the exploring if COSMOS' effectiveness is the same for educational levels and genders or not.

***Table** 17.* Comparison of science attitudes and action competence of students in COSMOS school at t1, from primary (n=745) and secondary (n=908) schools.

Variables	Primary *M ± SD*	Secondary *M ± SD*	*t*	*p*	*d*
Career aspirations	2,94 ± 1,26	2,47 ± 1,17	-7,704	<0,001	-0,384
Science is interesting	3,06 ± 0,78	2,74 ± ,079	-8,242	<0,001	-0,407
Science is boring	2,18 ± 1,13	2,26 ± 1,08	1,447	0,148	n/a
Science is for boys	1,87 ± 1,31	1,78 ± 1,18	-1,541	0,123	n/a
Science is relevant	3,67 ± 1,10	3,29 ± 0,98	-5,364	<0,001	-0,268
Science is difficult	2,35 ± 0,98	2,58 ± 0,99	4,763	<0,001	0,235
Knowledge of action possibilities	3,38 ± 1,12	3,26 ± 0,92	-2,325	0,020	-0,147
Confidence in own influence	3,24 ± 1,17	2,84 ± 1,01	-7,361	<0,001	-0,369
Willingness to act	3,24 ± 1,19	3,04 ± 1,05	-3,555	<0,001	-0,275

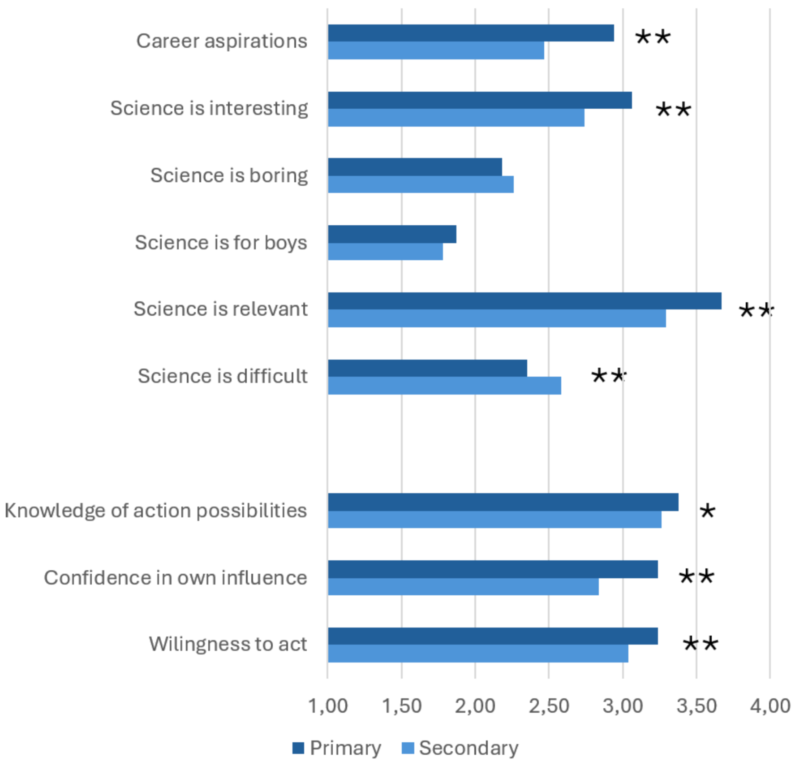

***Figure** 10.* Comparison of science attitudes and action competence of students in COSMOS school at t1, from primary (n=745) and secondary (n=908) schools ** marks p<0.05 ** marks p<0.00*

***Table** 18.* Gender difference at t1 in COSMOS schools. n(boys) = 818, n(girls)= 779.

Variables	Girls *M ± SD*	Boys *M ± SD*	*t*	*p*	*d*
Career aspirations	2,71 ± 1,21	2,63 ± 1,25	1,334	0,182	n/a
Science is interesting	2,88 ± 0,81	2,89 ± 0,80	-0,105	0,916	n/a
Science is boring	2,17 ± 1,07	2,27 ± 1,15	-2,037	0,042	-0,102
Science is for boys	1,30 ± 0,72	2,31 ± 1,41	-18,042	<0,001	-0,890
Science is relevant	3,56 ± 1,03	3,47 ± 1,07	1,721	0,086	n/a
Science is difficult	2,39 ± 0,99	2,55 ± 0,98	-3,036	0,002	-0,152
Knowledge of action possibilities	3,36 ± 1,00	3,27 ± 1,03	1,654	0,98	n/a
Confidence in own influence	3,08 ± 1,09	2,96 ± 1,12	2,275	0,023	0,114
Willingness to act	3,23 ± 1,12	3,02 ± 1,12	3,694	<0,001	0,185

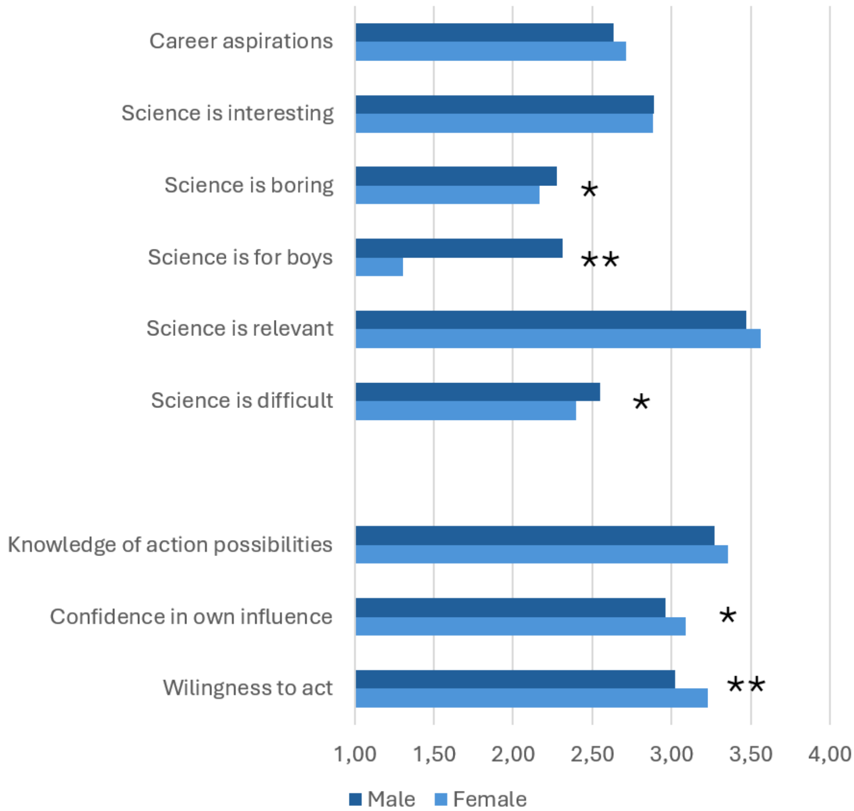

***Figure** 11.* Gender differences at t1 for both round combined in COSMOS schools. n(boys) = 818, n(girls)= 779.
** marks p<0.05 ** marks p<0.001*

To answer each of the questions into the specificity of the results of the COSMOS approach, we opted for an exploratory analysis that looks into mean differences among students in terms of their increase (or decrease) in their values for the independent variables science interest, science tediousness, science relevance, knowledge of action possibilities, confidence in own influence and willingness to act. These are all the variables for which during round 1 and/or during round 2 we observed project wide statistically effects when comparing values of the same students before and after participation in COSMOS. For comparing schools, we performed ANOVA for each of the variables, which the school identifier as grouping variable. For the other two types of specificity, we performed independent samples t-tests with educational level and gender respectively as grouping variable.

Table *19*. Specificity of COSMOS effects when comparing pre-post implementation values.

Outcomes variable (difference t2-t1)	Specificity of COSMOS effects pre-post implementation		
	Schools	Educational level	Genders
Science is interesting	F = 1,821 p = 0,026*	t = 0,948 p = 0,344	t = -1,625 p = 0,105
Science in boring	F = 1,086 p = 0,365	t = -0,973 p = 0,331	t = -1,288 p = 0,199
Science is relevant	F = 0,927 p = 0,538	t = 1,508 p = 0,132	t = 0,462 p = 0,644
Knowledge of action possibilities	F = 1,110 p = 0,342	t = -1,295 p = 0,196	t = 0,633 p = 0,507
Confidence in own influence	F = 1,260 p = 0,218	t = 1,114 p = 0,266	t = 0,080 p = 0,936
Willingness to act	F = 1,036 p = 0,416	t = -0,322 p = 0,741	t = 0,632 p = 0,528

The results in Table 19 reveal that when we compare all schools in their difference between t1 and t2 data from the student survey, we see that only for interest in science there is a general effect (F = 1,821, p = 0,026), with an effect size (η^2 = 0,051) that indicates a small effect. This should be interpreted as there being statistically significant difference among the schools that participated in COSMOS in terms of the increase that we observed in their students' interest in science. In other words, the COSMOS approach has produced school specific effects on the students' interest in science. For the purposes of the current evaluation report we do not delve into which schools differ from which schools, nor do we aim to explain why some schools differ from the overall effect of COSMOS. For all other outcome variables for which we observed effects of COSMOS, no significant main effects could be detected through ANOVA.

This does not mean that there are no differences whatsoever among the schools in terms of how much COSMOS contributed to the students' learning in these science attitudes and action competences, but rather that using the sample we have within the project does not allow us to establish whether or not these are significant. Overall, these results point towards a universally present effect of COSMOS at project level, across all schools, with indications that for interest in science specifically the schools do differ. Furthermore, as can be seen in Table 19 as well, we detected no statistically significant differences in the extent to which COSMOS has an effect on students in participating primary or secondary school, nor on students who identify as male or female. While we did observe medium to large difference between female and male student (e.g. in their gendered views of science), our results show that COSMOS affect them equally. Overall, the current results support the claim that COSMOS has a universal impact that is similar for students in primary and secondary education as well as for female and male students.

(4) What else do students report as learning outcomes of their participation in COSMOS?

Beyond the participating students' attitudes towards science and action competence, which were topic of the student surveys, in the student group interviews we also explored which other learning outcomes are attributed by the students to their participation in COSMOS. Below we present an overview and examples of quotes reflecting student voice of such learning outcomes. It should be noted that these do not represent project-wide claims, but rather the individual reflections of selected students who participated in the group interviews.

Through thematic analyses of all student interview data, eight different topics emerged, as listed below. These are presented in random order and therefore do not reflect a ranking in terms of importance. Rather they should be understood as learning outcomes that students themselves connect to the learning experience through their participation in COSMOS. The quotes below highlight the diversity in themes that were addressed by students in the post group interviews.

Connection to nature

"I even overcame my fear of bees, even being able to touch them" (I1D)

Deep learning

"When you find ways to explain your knowledge to others in abstract ways, it increases your own understanding." (I2E)

Awareness of impact on the community

"We can have Arab and Jewish children learn together, engage in activities related to healthy eating, what food to put in our lunchbox, how to lose weight." (I2C)

Awareness of diversity

"People are different, with different feelings and can be understood differently. (I2C)

Science as a profession

“scientists don’t learn from a book and do experiments, they kind of think of things for themselves so that’s how it links to what we did”... “and they find new solutions to the problems that they’re trying to figure out, and that’s what we were doing.” (U1B)

Critical thinking

“Working with AI, well we have learnt about how to be critical, to think if what we see is true or fake, for instance in social media” (S1A)

Science careers

“I think maybe...my brother does, he’s a physicist, so maybe I will go into that as well, but I don’t know. I enjoy other things as well, but I think even if I didn’t take science as a job, it kind of is still everywhere, everything has a background to it in something scientific.” (U1B)

Multi-perspectivity

"I think it's because it makes us, humans, put ourselves in someone else's shoes, which is often difficult for many people (...) and to put ourselves in the other person's shoes and understand what is affecting them or not and what we could do, how we would like to be helped. So I think it puts us in an introspective phase to improve." (P2C)

g) Summary of COSMOS impact on students

The takeaways from these analyses are that they show project wide (across all schools) evidence for the implementation of the COSMOS approach on students' learning outcomes. Both their attitudes towards science and their action competence are impacted by participating in SSIBL-CoP implementations at their schools. In the first implementation round we observed increases in students' perceptions of science as interesting and relevant. In the second round, similar effects were observed but additionally there was also evidence that there is a decrease in students' perception of science as boring. Across both implementation rounds, we did not observe changes in students' science career aspirations, nor in their perception of science as difficult. They might be connected to the concrete implementation decisions taken by educators and other members of the CoPs. As can be read in the reports on these implementations in primary (D3.2) and secondary schools (D4.2), there was often no overt focus on career aspirations. However, the student group interviews revealed that while no overall effect on career aspirations could be observed, selected students did experience their participation in the COSMOS project as contributing to their understanding and appreciation of careers in science.

Overall, these results need to be understood within the context of the SSIBL pedagogy. This approach to science education puts personally relevant socio-scientific issues in the fore front (ASK) and explicitly addressed connection between such issues, society and learners' everyday life (FIND OUT). Increased interest in science and perceived relevance among students in the project make sense in this light. Furthermore, as the SSIBL pedagogy culminates in exploring, design and bringing action into practice (ACT), the results relating to students' action competences are encouraging as well and highlight the potential that SSIBL has for open schooling to contribute both to students science attitudes and their active citizenship in contributing to a more sustainable future through science education. Building on that, our results also highlight the potential of SSIBL-CoP in achieving impact both in primary and in secondary education, and they also reveal that there is no gender specificity in its impacts: all increases in key learning outcomes were observed for boys and for girls in similar effects.

Beyond what we learned in terms of the effect of COSMOS from the students' surveys, the group interviews shows that the implementation of SSIBL-CoP can present students with opportunities to learn more about science careers, societal diversity, and critical thinking.

2.3.1.2 The effect of COSMOS implementation on teachers

The effect of COSMOS implementation on teachers was measured by organizing a focus group with the teachers at the participating schools, and/or by doing an individual teacher interview. Regarding the choice to conduct a focus group or individual teacher interview, each partner decided what made sense in their context. Together, the results of the focus groups and individual teacher interviews allow us to present a nuanced overview of the impact of COSMOS on their (science) teacher identity. It is important to note here that the focus within this report lies not on comparing countries of different implementations to each other. Rather the focus goes to presenting evidence on if and how the COSMOS project contributes to a change in the (science) teacher identity of the participating teachers.

a) Questions asked to answer through teacher data

Qualitative data collection from teachers participating in the COSMOS project was aimed at answering two questions. Together, they allow us to present a nuanced overview of the impact COSMOS has had on the teachers. The driving question for this section of the evaluation is:

How does participating in COSMOS contribute to the development of a SSIBL teacher identity?

We seek to answer this question from an eagle eye perspective across teachers' experiences within the COSMOS project. Where relevant we also zoom in on experiences relating explicitly to teacher professional development activities. More information on our approach to teacher professional development can be found in the COSMOS TPD handbook (D5.2).

b) Data collection procedure

The effect of COSMOS implementation on teachers was evaluated through the analysis of qualitative data. After the end of the first and the second implementation round, we organised focus groups – concerning this evaluation question together with the questions about pedagogical processes and organisational processes (see section 2.3.2 and 2.3.3) - with the participating teachers. Higher education partners could decide to implement questions about the (science) teacher identity in an individual interview with teachers instead of the focus group, depending on the teachers' needs and context. Data collection for the focus groups – or individual teacher interviews - was coordinated locally by each higher education partner. In each implementation round, the focus group about the (science) teacher identity took place at the end of the implementation round after the school itself considered the SSIBL-CoP implementation to be complete but before the end of the school year. Focus groups or individual teacher interviews were always conducted in their language of instruction at the school. The focus groups were audio-recorded and then transcribed verbatim at the researcher's earliest convenience. In line with ethical clearance, once transcribed the audio-recordings were deleted. Focus groups lasted about 45-90 minutes depending on local issues, and happened in person at the school or online if preferred by the teacher team.

In what follows, the results of 61 focus groups with CORPOS/CoP members or individual teacher interviews can be found across countries. In each focus group, at least the teachers of the classes that implemented SSIBL-CoP were present. The participation of the school leader or other members of the CoP (students, parents, non-formal science learning centers, local policymakers ...) was optional. The focus group was led by a member from the COSMOS consortium (HEI and/or SP), depending on the local context.

c) Analytical procedure

First, the focus group was thematically analyzed through a deductive and inductive procedure by researcher(s) within each of the national contexts. The procedure was guided by a manual for evaluators to streamline the process and support reliability and validity of the data (see Table 2). The analysis of the data started at implementation level, meaning that for each COSMOS implementation in each school a template was filled in about how COSMOS contributed to the process of teacher professional learning, and SSIBL teacher identity development. Afterwards the information collected in these implementation level templates was aggregated into country level reports which were then shared with the team coordinating the evaluation work for COSMOS. The manual and templates for evaluators can be found in Appendix 1. In this current report we present findings that emerged from an aggregation process of the country-specific results into a project-wide overview.

d) Results and interpretations

Teachers indicate that the COSMOS implementation in schools had a clear impact on their professional growth, their teaching approaches, and their perception of science education (SE). They report that the experience encouraged a shift from traditional, rigid teaching methods (more in line with vision I of science education) to more flexible, inquiry-based, and student-centered approaches, although the degree of change varied across school settings and individual teachers (in line with vision II and III of science education).

In secondary schools, where science curricula are often more rigidly structured, teachers initially found it challenging to engage in COSMOS, a project which starts without clearly defined end goals but that is rather driven by a pedagogical vision guiding next steps that can be taken. This uncertainty, however, allowed teachers to experience a new level of adaptability and responsiveness in teaching. They gained confidence through the project's iterative nature, which opened up possibilities for integrating self-regulated learning and student autonomy in science education. Teachers were particularly surprised by the depth of students' self-regulation, which motivated them to incorporate more student-initiated learning approaches into their subjects. This experience reshaped some teachers' views of science education, helping them see the value of allowing students greater agency.

> *"the uncertainty is challenging but it was fascinating to experience a project in which decisions are made during the project and I gained confidence in this."*
>
> *(I2E2)*

In primary schools, participating teachers mentioned the collaborative environment strengthened ties between students, parents, and local stakeholders, fostering a collective commitment to activism and community-oriented goals. Teachers reported that these activities reinforced their capacity to design science inquiry-based learning around real-world issues, allowing students to explore social and environmental topics through projects that connected science education to citizenship. Teachers saw how hands-on projects and the inclusion of an ACT phase—encouraging students to advocate for change—helped students understand their role in affecting their environment and fostered an appreciation for responsible citizenship.

"... significant involvement of the learning community- students, parents and professionals from within the community- worked together towards a mutual goal, and through this they both increased the community's awareness concerning the issue and strengthened the community." (I2D2)

Across both primary and secondary schools, the COSMOS project led some teachers to adopt a more interdisciplinary approach, incorporating humanities (social inquiry) into science education. Teachers found that connecting science education with humanities made science feel more relevant to students, enhancing their engagement. In particular, they observed that students gained a stronger sense of agency and ownership in their learning, as the projects encouraged them to apply critical thinking to societal issues and engage directly with their communities.

'I personally notice for many students STEM education is sometimes a bit of a distant concept, because they don't really see how it affects them yet. So all very nice to talk about those food chains, but what do I have to do with that? [...] so I think STEM I notice with students that it's harder for them to see how they have an impact and how what they do affects them. And I think that with social research like this, you're going to hit that, I hope, I think.' (N2A2)

Additionally, teachers benefitted from enhanced professional development through collaboration with colleagues during TPD sessions and one-on-one meetings with COMOS educators and external stakeholders. Many valued the chance to share knowledge, reflect on practices, and learn new teaching strategies that they could adapt to various contexts.

"I really enjoyed the professional growth and learning base, which is very important through the exchange of experiences among teachers" (P2B2)

Teachers also expressed that this experience helped them realize the potential for creating dynamic learning experiences beyond the traditional classroom, as they became more confident in designing and implementing projects that connect students with real-world scientific and social issues.

'Well, because we set up three very different projects, or products. Since I had the same working method [SSIBL approach], and some variation in it for my lessons, I am now well experienced in that. So now, should there be a topic in

the future, I can work on that myself to develop another beautiful, beautiful lesson as well'. (N2B2)

The COSMOS experience did not necessarily change the teacher (science) identity, but for some of them rather confirmed the alignment of their values with COSMOS's innovative and collaborative teaching approach. Many teachers found this method reinforced their own beliefs about the importance of fostering student agency and real-world relevance in education, although some were initially skeptical about the students' ability to handle such autonomy. After observing positive outcomes, teachers felt validated in adopting more inquiry-driven, student-centered methods. The COSMOS implementation also underscored the importance of a supportive CoP, enabling teachers to rely on mutual learning and community resources, which contributed significantly to their professional growth and resilience in adopting these new teaching methods.

This group (the class) is very hard worked and I really felt like I was throwing myself into deep water when there wasn't much steering to begin with. Those of us who were involved agreed that almost all students worked better in this way than they normally do. Of course, it requires some thought to get something else done, but in this case it was worth it. I can definitely imagine us testing it in some more areas. (S2B2)

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e) Summary of COSMOS impact on teachers

In conclusion, participating teachers report that implementing SSIBL-CoP into their teaching led to substantial professional development, encouraged them to explore student-centered, inquiry-based, and community-oriented approaches. It broadened their pedagogical practices, enhanced collaborative skills, and helped them see the positive impact of teaching science in ways that connect more directly to students' lives and their communities. They mention that this experience increased their awareness of the value of student autonomy and specifically social inquiry in science education. Furthermore, teachers reported that participating in COSMOS empowered them to pursue such approaches in their own educational practice in the future.

The conversations in the focus groups and/or (where relevant) individual teacher interviews, revealed that many of the teachers that participated in COSMOS were in the process of developing a SSIBL teacher identity that we have been aiming for. Now, these teachers are flexible and open to innovation, they feel more confident in reaching out to members of the communities of practice and external stakeholders. They value and seek to develop pupil autonomy and personal relevance in their science teaching.

2.3.1.2 The effect of COSMOS implementation on school organization

The effect of COSMOS implementation on school organization was evaluated by organizing a focus groups with the CORPOS Open Schooling Teams of the participating schools. The results of the focus groups allow us to present a nuanced overview of the impact of COSMOS on a more open science education in the schools. It is important to note here that the focus within this report lies not on comparing countries of different implementations to each other. Rather the focus goes to presenting evidence if and how the COSMOS project contribute to a change in school openness of the school organization.

a) Question asked to answer through teacher data

Qualitative data collection from teachers – and sometimes school management or other stakeholders - participating in the COSMOS project was aimed at answering the following evaluation question:

What is the effect of COSMOS implementation on the school organisation?

b) Data collection procedure

The question towards the impact of COSMOS implementation on the school organization was evaluated through qualitative data collection. After the end of the first and the second implementation round we organized a focus group – concerning this evaluation question together with the questions about pedagogical processes and organizational processes – in each school with the CORPOS members involved.

Data collection for the focus groups was coordinated locally by each higher education partner. In each implementation round, the focus group about organizational outcomes took place at the end of the implementation round after the school itself considered the SSIBL-CoP implementation to be complete but before the end of the school year. Focus groups were always conducted in their language of instruction at the school. The focus groups were audio-recorded and transcribed verbatim at the researcher's earliest convenience. In line with ethical clearance, once transcribed the audio-recordings were deleted. Focus groups lasted about 45-60 minutes depending on local issues, and happened in person at the school or online if preferred by the CORPOS.

The focus groups that were used to answer this question were part of the wider teacher professional development approach within COSMOS as well as that they helped guide SSIBL-CoP implementations in the schools. During the initiation phases of both implementation rounds focus groups were also held to assess the starting point of the school in terms of openness (as perceived by the members of the open schooling team). These focus groups were part of the goal setting process that each of the schools went through (see also the TPD handbook D5.2). Within this, they identified one or several of the school openness dimensions as goals they wanted the SSIBL-CoP implementation to contribute to. In the focus groups discussion that were organized after the implementations, these selected dimensions were used of themes for the open school team members to reflect on. For each of the selected dimension they considered if and how COSMOS had contributed to an outward move, either in their science education or perhaps even at the level of the school as an organization. The focus groups also invited participants to reflect on any or all other dimensions of school openness.

In what follows, the results of 61 focus groups with CORPOS members can be found across countries. In each focus group, at least the teachers of the classes that implemented SSIBL-CoP were present. The participation of the school leader or other members of the CoP (students, parents, non-formal science learning centers, local policymakers ...) was optional. The focus group was led by a member from the COSMOS consortium (HEI and/or SP), depending on the local context.

c) Analytical procedure

The focus groups were thematically analyzed through a mixed inductive and deductive procedure by researchers within each of the national contexts. To structure the coding, we used the dimensions of the ecological model of school openness (Sarid *et al.*, 2024). The procedure was guided by a manual for evaluators to streamline the process and support reliability and validity of the data. The analysis of the data started at implementation level, meaning that for each COSMOS implementation in each school a template was filled in about the CORPOS Open Schooling teams experiences of organizational outcomes. Afterwards the information collected in these implementation level templates was aggregated into country level reports which were then shared with the team coordinating the evaluation work for COSMOS. The manual and templates for evaluators can be found in Appendix 1. In this current report we present findings that come from aggregation of the country-specific results into a project-wide overview.

d) Results and interpretations

Regarding the teachers, a major factor that contributed to their movement to more open schools was their participation in two implementation rounds. In these cases, schools were supported for the duration of two years in all the aspects of developing and implementing SSIBL-CoP pedagogy, and in the end towards a more open school.

In schools where only one teacher participated from a science specific subject developed a project for one class or one grade, the teacher considered the contribution of the COSMOS implementation little or less to the school openness as a whole. Also, the contributions to science education as a whole were considered limited. However, these teachers think that the contribution of COSMOS will grow over the years as they are going to work with colleagues from the same grade and subject and diffuse their experience and materials towards openness and the implemented SSIBL-CoP approach amongst them. In the same way, when they teach more than one science subject and the developed expertise will be used in the other science subjects or projects to the contribution of the COSMOS implementation will emerge.

Mentioned key processes of the COSMOS approach to the more outward movement on the dimensions are: the internalization of SSIBL-CoP approach, the use of a COSMOS worksheet (sort of lesson plan with SSIBL phases), the one-on-one sessions developing lessons with COSMOS higher education institutions or societal partners and the CORPOS/CoP meetings.

Most participants in the focus group discussion reported that their participation in COSMOS has influenced school openness across all eight dimensions, creating a shift towards more outward-oriented education. Because in each implementation at each school only one or a couple of dimensions were chosen as a goal to develop through COSMOS, we do not provide extensive examples for each of them. Below we present high level summaries of reported results for each of the dimensions.

1. **Shared governance**: The CORPOS members indicate that if each school member (teachers, school leaders, students) manages their specific area of expertise, this is enhancing for collaboration and supporting among staff based on their competencies. Trust and support from the school administration were significant, promoting a culture of mutual respect and shared responsibility.

2. **Open curriculum**: For some schools, the curriculum around the chosen SSI became more diverse and flexible. The content was integrated into more subjects which led to enhancement of the amount of inner school communities.
3. **Inner school communities**: In various schools the COSMOS approach supported the formation of collaborative teacher groups or communities of practice (CoP), which promoted professional growth and collaborative problem-solving.
4. **Learning communities**: The CORPOS members mentioned the emergence of greater teamwork while developing a SSIBL-CoP implementation. The responsible CoP acted as an active learning community, sometimes also together with their students.
5. **Student participation**: According to the experience of the CORPOS members the SSIBL-CoP implementation significantly advanced student participation, giving students a voice in the learning process. For example, students helped design the syllabus, chose research questions, chose the kind of inquiry (scientific – societal – personal) and engaged in projects that led to real actions like local environmental improvements, increasing engagement, more active learning and responsibility. In addition, the SSIBL-CoP implementation provided a lot of room for formative assessment – feedback from students and adapting activities/ lessons based on students' feedback and questions.
6. **Parental involvement**: The data of the focus groups with the CORPOS members indicate that some – mainly primary - schools involved parents in designing engaging activities, such as collaborative workshops and afterschool environmental projects. Some schools made a distinction in between 'presence' and 'involvement'. Although parents attended events, active involvement varied. Schools with more hands-on parental activities (e.g., gardening, healthy eating sessions) reported better participation.
7. **Social engagement**: The teachers stated that working on an issue that has implications for the whole community led to enhanced social engagement around the issue. Also the finding of relevant SSIs for students raised their social engagement around this issue.
8. **Community collaborations**: Community partnerships strengthened within the COSMOS project mostly with the collaboration with the higher educational institutes and societal partners, but sometimes also with additional partners. The CORPOS members indicated that the communities that collaborated with the school around the SSI both grew in number and diversified as the school received requests from new stakeholders to become partners in the school community. For some schools, in the past it was more difficult to link with scientific organizations than with societal organizations since there is less benefit for these institutes in collaborating with a more STEM oriented school. But the science education section showed now (through this project) that they also can contribute to more socially oriented topics. Participating schools collaborated with local councils, universities, and environmental organizations, transitioning from superficial partnerships to engaged, mutually beneficial collaborations. This "outward movement" helped schools create a supportive network for the project sustainability and raised broader impact.

e) Summary of COSMOS impact on school organization

The results of these focus groups show that implementing SSIBL-CoP has the potential to contribute to a move towards more open modes of science education and open schooling in general. This teachers' movement towards more open schools was largely driven by their participation in two implementation rounds of the COSMOS project, which provided sustained support over two years in developing and applying the SSIBL-CoP pedagogy. Schools with broader engagement from multiple teachers and subjects saw greater contributions to school openness and science education. Key processes for promoting openness included the internalization of the SSIBL-CoP approach, use of COSMOS worksheets, one-on-one lesson development with partners, and CORPOS/CoP meetings.

Focus group discussions revealed the potential of COSMOS to influence school openness across all eight key dimensions. The CoP members mention shifts in shared governance, fostering trust and collaboration among staff. Inner school communities were enhanced as the COSMOS approach encouraged teacher collaboration and professional growth. Learning communities emerged as active CoPs that engaged teachers, students and other actors. Student participation significantly increased in the SSIBL-CoP implementations as compared to earlier efforts in science education, with students taking an active role in syllabus design, project-based learning and designing and enacting their own responses to SSIs. Parental involvement varied, but schools with hands-on activities reported better engagement. Social engagement grew as students and teachers worked on issues impacting their communities. Finally, community collaborations flourished, with schools developing stronger, more diversified partnerships, enhancing project sustainability and broadening its impact through connections with local councils, universities, and environmental organizations.

The analyses of the focus group data suggest that these shits are highly school specific processes that are influenced by many school related and contextual barriers and facilitators. In Part B of this report we zoom in specifically on these process characteristics for each of the eight school openness dimensions

2.3.1.3 The effect of COSMOS implementation on other stakeholders

We evaluated the impact of COSMOS implementations on other stakeholders by organising a focus group with the societal partners of the COSMOS consortium. At the core of the project are six academic partners – higher educational institutes (HEI; formal education partners) specialised in science teacher education. In each country a specific societal partner (SP; non-formal education partner) has been selected to complement the consortium from a specific stakeholder point of view.

The societal partners that participated in the implementations at schools were consulted with a focus on their role in the implementations and what they have learned themselves from this. The focus group with representatives from each societal partner provide qualitative data that gives insight into pedagogical processes as well as their outcomes (EQ1-2).

The results are mentioned as outcomes of the COSMOS project by these six societal partners: Djapo (Belgium), Winchester Science Centre (United Kingdom), Ciência Viva (Portugal), Alma Löv museum for Unexpected Art (Sweden), the Ministry of Education (Israel) and the University Museum of Utrecht (the Netherlands).

a) Questions asked to answer through societal partner data

Qualitative data collection from societal partners participating in the COSMOS project was aimed at answering two questions. Together, they allow us to present a nuanced overview of the impact COSMOS has had on the societal partners. The driving questions for this section of the evaluation are:

(1) What lessons do you take away from COSMOS concerning science education?

(2) What lessons do you take away from COSMOS on the level of your organisation?

b) Data collection procedure

The effect of COSMOS implementation on societal partners was evaluated through qualitative data collection. After the end of the second implementation round we organized a focus group with at least one staff member of each societal partner. Data collection was led by the responsible project partner for monitoring and evaluation. The focus group interview was conducted in English. The interview was audio-recorded an then transcribed verbatim by the responsible partner. In line with ethical clearance, once transcribed the audio-recordings were deleted. The focus group lasted about 100 minutes and happened partially in person and partially online, depending on the attendance of the societal partner at the consortium meeting in May 2024.

c) Analytical procedure

First, the focus group was thematically analyzed through an inductive procedure by the responsible project partner. Afterwards the focus group data was member checked by all of the societal partners to check for accuracy and validity. The focus group scheme can be found in Appendix 5.

d) Results and interpretations

From the qualitative data of the focus group, three core areas of learning through COSMOS for societal partners were identified: open science education, school leadership and schoolwide collaboration, and collaboration with diverse stakeholders towards a more open science education approach & professional development as a societal partner. Some societal .... partners? are currently in the process of integrating the COSMOS concepts and approaches in their professional development courses or trainings. They highlighted exchanging with other societal partners about using the concept in a different context has been inspiring in adapting practice in different situations. The key area of impact they have experienced are:

Open science education

The COSMOS project enriched the societal partners with knowledge and skills on open science education and in addition how to make it more relevant for the students. They learned how to bring open science education into practice through simple as well as more complex educational interventions. In more detail, they report discovering concrete small steps in engaging partners in the community regarding a specific SSI toward contributing in communities of practice. More broadly they indicate learning to reflect and practice possible pathways for collaboration & partnerships between out-of-school institutions, schools and universities.

The societal partners shared that a key insight from them was that open science education does not just open up or break down the walls of the classroom, but it is also an eyeopener for students to feel that they can make a difference beyond the classroom through actions that they take within their science education. Specifically the SSIBL-CoP pedagogy is mentioned as an effective tool in the empowerment of children towards active citizenship. One of the participants in the discussion, mentioned that the SIBBL framework was interesting for them to compare with other pedagogical frameworks about science education (e.g. a model called *STEMOOV*), and specifically the three types of inquiry (scientific, social and personal) of the FIND OUT phase, and the action-orientedness of the ACT phase can be inspirational to further strengthen other pedagogies towards contributing to more open schooling.

Some societal partners shared that as a result of participating in COSMOS, and supporting schools to implement SSIBL-CoP, they have found support that reinforces the conviction that that confining education to classrooms feels no longer relevant to them. They felt the need to connect the real life world with science topics more strongly and have become convinced that this is the way to develop science education even stronger. The SSIBL-CoP-pedagogy provides a strong foundation to develop different scientific concepts outside the traditional classroom. Finally, several societal partners mention that to bring open schooling into science education, a strong foundation of science content knowledge and general didactics skills is essential to build upon.

The crucial role of school leadership and schoolwide collaboration

The societal partners voice that teachers need to feel supported by school leadership in order to have time, resources, ... to establish a CoP and to design and implement lesson plans collaboratively. While school leadership is not an absolute precondition for a successful CORPOS (open schooling team) that initiates CoP and bring SSIBL into practice, if the leadership is at least interested and motivated to support, it increases the success of the initiatives taken. Societal partners mention that they have grown to understand more profoundly that the teacher(s) who is in charge of a SSIBL-Cop implementation project, should have the leadership tools to respond to resistance within the team. Resistance could have to do with available time, the will to deviate from the business as usual. The societal partners emphasized on the fact that there is a need for awareness for every teacher making progress at their own pace. The key there is to 'celebrate' each small step.

More specifically, one societal partner thought it is necessary to mention teaching outside of the classroom does not fit all teachers. Teaching outside of the classroom requires an open mindset, courage to go outside and leave the books in the classroom. It also requires a curiosity and abilities to act. As a principal or teacher who is in charge, you need to be aware of this and guide these teachers more gently through the SSIBL-CoP implementation and open schooling process.

According to societal partners it is crucial to engage different actors from the school organisational level (e.g. diverse teachers, sciencec, art social science, language, the school managament, and even ground keepers, gardeners). The buy-in of the whole school is vital to ensure sustainability and to make sure concepts do not disappear when staff changes occur. Before you're able to design a SSIBL-CoP implementation every member of the school team needs to speak the same language and use a common vocabulary: stakeholders, community of practice (CoP), sharing their experiences, the societal partners mentioned the active involvement of school staff – on all levels and all subject teachers in secondary schools - contributes to the quality of a collaboration. A meeting with all involved staff (societal partner and school) prior to participation of students creates a better understanding and interest for each other's workspaces and methods.

Teachers found it difficult to involve each other/the team in the COSMOS story. The societal partners mentioned that that they noticed that the presence of school management in the sessions could be an added value in order to arrive at a broad approach at school. Teachers feel insecure about leading these change processes and it might be interesting to state more explicitly in advance what can be learned from the project for a school management.

Some of the societal partners, especially those involved in supporting schools and providing professional development, voice that because of their participation in COSMOS, they have become more aware of the role they themselves can play in this process, e.g. by explicitly putting school leadership issues on the table when initiating new collaborations with schools, or by providing professional development and support for school leaders.

Collaboration with different stakeholders towards a more open science education approach

Several societal partners mentioned the importance of the increased collaboration in between higher educational institutions and societal partners in terms of relationship building. They indicated a much better understanding of the concepts embodied within the project and this has influenced their own organisational practices. According to societal partners, the language used by higher education institutes, societal partners and school can differ a lot. Clear and 'popular' language and definitions of key concepts are critical prior to collaboration. They call to work with what is relevant to societal partners and schools in their work and avoid unnecessary complications or confusion. The objectives of collaborating partners can differ and potentially conflict. Clear communication that helps to distinguish and address these objectives are of huge importance. Distinguish and address student learning objectives from teacher learning objectives from data collection objectives from commercial objectives. This distinction matters and makes the collaboration easier. Several of the societal partners recognize that they can play a role in facilitating such communication.

2.3.2 Pedagogical Processes

The critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools were collected by organising a focus group with the Communities of Practice (CoPs).

a) Question asked to answer through teacher data

Qualitative data collection from teachers – and sometimes school management or other stakeholders - participating in the COSMOS project was aimed at answering the second evaluation question:

Which are the critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools?

b) Data collection procedure

The question towards critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools was measured through qualitative data collection. After the end of first and the second implementation round we organized a focus group – concerning this evaluation question together with the questions about stakeholder outcomes and organizational processes - with the CoP members involved.

Data collection for the focus groups was coordinated locally by each higher education partner. In each implementation round, the focus group about pedagogical processes took place at the end of the implementation round after the school itself considered the SSIBL-CoP implementation to be complete but before the end of the school year. Focus groups were always conducted in their language of instruction at the school. The focus groups were audio-recorded an then transcribed verbatim at the researcher's earliest convenience. In line with ethical clearance, once transcribed the audio-recordings were deleted. Focus groups lasted about 45-60 minutes depending on local issues, and happened in person at the school or online if preferred by the teacher team.

In what follows, the results of 61 focus groups with CoP members can be found across countries. In each focus group, at least the teachers of the classes that implemented SSIBL-CoP were present. The participation of the school leader or other members of the CoP (students, parents, non-formal science learning centers, local policymakers ...) was optional. The focus group was led by a member from the COSMOS consortium (HEI and/or SP), depending on the local context.

c) Analytical procedure

First, the focus group was thematically analysed through an inductive procedure by researcher(s) within each of the national contexts. The procedure was guided by a manual for evaluators to streamline the process and support reliability and validity of the data. The analysis of the data started at implementation level, meaning that for each COSMOS implementation in each school a template was filled in about the CoPs experiences of pedagogical processes.

Afterwards the information collected in these implementation level templates was aggregated into country level reports which were then shared with the team coordinating the evaluation work for COSMOS. The manual and templates for evaluators can be found in appendix X. In this current report we present findings that come from aggregation of the country-specific results into a project-wide overview.

d) Results and interpretations

In this section we will address the COSMOS evaluation question about pedagogical processes using results from the relevant qualitative analyses. The facilitators and barriers were all mentioned by the participating CoP members within the different COSMOS countries.

Facilitators towards SSIBL-CoP implementation, and illustrative examples

- ***Development of inner school and learning communities :*** Activities where older students guided younger ones through science experiments promoted peer learning and integration. Teachers also formed communities of practice, fostering professional growth and collaborative problem-solving, which created a supportive learning environment for SSIBL principles.
- **Community collaborations :** Local entities like the city council or municipal learning centers and other organizations expanded project possibilities and provided additional support. Parents contributed to materials for projects, ensuring alignment with community needs and enhancing available resources

- **Principal's leadership :** The openness of the leadership to bring innovative projects into the school and their ongoing involvement in new processes, translates into practical support for the team involved in implementing the change process. Such leadership regarding innovation and change percolates down to all practical aspects of the project.
- **Relevant socio-scientific issues (SSI) :** Choosing SSI that resonated with students' daily lives or community challenges engaged students and encouraged parental and community involvement. Selecting relatable themes helped develop meaningful inquiries and motivated students to act on their findings.
- **Emphasis on student participation and activism :** Empowering students to lead inquiries and engage actively fostered deeper learning and a sense of responsibility towards community issues, promoting skills in citizenship and problem-solving.

Barriers towards SSIBL-CoP implementation

- **Time constraints :** Integrating project activities into the existing curriculum proved challenging, especially in grades with national exams. It takes also more time to plan and work together with more people involved, just to find time in several schedules can therefore be a challenge.
- **Rigid curriculum requirements and evaluation methods :** A closed curriculum obstructed the full adoption of innovative teaching practices, making it difficult to balance standardized testing demands with the exploratory nature of SSIBL-CoP.
- **Teacher workload :** Teachers often faced increased workloads, making it difficult to balance project implementation with other teaching responsibilities.
- **Knowledge and competence requirements for teachers :** Implementing SSIBL-CoP required teachers to develop a complex set of knowledges and competences. Some teachers, particularly those unfamiliar with socio-scientific approaches, found it difficult to balance traditional teaching with the demands of SSIBL.
- **Teacher Turnover :** In schools with high turnover among key teachers, SSIBL-CoP faced disruptions. New teachers required time to adapt, which slowed continuity and progress.
- **External challenges (f.e. war or physical limitations) :** External factors like conflict impacted teachers' emotional readiness and restricted physical learning spaces, though some schools found that community resilience emerged as a result.
- **Lack of summative assessment of SSIBL-CoP implementation :** If the project was not graded or in a not-regular week of school, this resulted in lack of interest or feeling of urgence by some students.

2.3.3 Organisational Processes

The critical factors that facilitate or impede viable and sustainable CORPOSs in schools were collected by organizing a focus group with the CORPOS.

a) Question asked to answer through teacher data

Qualitative data collection from teachers – and sometimes school management or other stakeholders - participating in the COSMOS project was aimed at answering the third evaluation question:

Which are the critical factors that facilitate or impede viable and sustainable CORPOSs in schools?

b) Data collection procedure

The question towards critical factors that facilitate or impede viable and sustainable CORPOSs in schools was measured through qualitative data collection. After the end of first and the second implementation round we organized a focus group – concerning this evaluation question together with the questions about stakeholder outcomes and pedagogical processes - with the CORPOS members involved.

Data collection for the focus groups was coordinated locally by each higher education partner. In each implementation round, the focus group about organizational processes took place at the end of the implementation round after the school itself considered the SSIBL-CoP implementation to be complete but before the end of the school year. Focus groups were always conducted in their language of instruction at the school. The focus groups were audio-recorded an then transcribed verbatim at the researcher's earliest convenience. In line with ethical clearance, once transcribed the audio-recordings were deleted. Focus groups lasted about 45-60 minutes depending on local issues, and happened in person at the school or online if preferred by the teacher team.

In what follows, the results of 61 focus groups with CORPOS members can be found across countries. In each focus group, at least the teachers of the classes that implemented SSIBL-CoP were present. The participation of the school leader or other members of the CoP (students, parents, non-formal science learning centers, local policymakers ...) was optional. The focus group was led by a member from the COSMOS consortium (HEI and/or SP), depending on the local context.

c) Analytical procedure

First, the focus group was thematically analyzed through an inductive procedure by researcher(s) within each of the national contexts. The procedure was guided by a manual for evaluators to streamline the process and support reliability and validity of the data. The analysis of the data started at implementation level, meaning that for each COSMOS implementation in each school a template was filled in about the CORPOSs experiences of organizational processes.

Afterwards the information collected in these implementation level templates was aggregated into country level reports which were then shared with the team coordinating the evaluation work for COSMOS. The manual and templates for evaluators can be found in appendix X. In this current report we present findings that come from aggregation of the country-specific results into a project-wide overview.

d) Results and interpretations

In this section we will address the COSMOS evaluation question about organizational processes using results from the relevant qualitative analyses. The facilitators and barriers were all mentioned by some of the participating CORPOS members within the different COSMOS countries.

Establishing a CORPOS can be a top-down or a bottom-up process or a combination. A bottom-up process could be to apply SISBL-CoP during several consecutive years, gaining experience that may organically lead to creating a CORPOS. Schools need such experience gained from several years in order to reach a state-of-preparedness that enables establishing, in a bottom-up (emergent) process, a CORPOS Open Schooling team(that is independent of the SSI and CoP established around it) as part of the school organizational culture and structure.

Listening to the voice of the participating CORPOSs, the sustainability and viability of CORPOSs in schools depend on several barriers and facilitators.

Facilitators towards sustainable and viable CORPOS Open Schooling teams

- **Collaborative culture :** Strong collaboration among teachers to share ideas, resources and best practices is crucial for a sustainable and viable CORPOS implementation.
- **Student participation :** Involving students in the planning and decision-making processes can increase their engagement and investment in the outcomes and therefore make CORPOSs more effective and sustainable.
- **Administrative support :** Strong administrative support can help in aligning CORPOS with school goals and integrating it into the broader educational framework.
- **Support from Leadership :** School leaders who encourage innovation, shared decision-making, and an openness to addressing evolving community issues (such as socio-scientific challenges) greatly contribute to the longevity of the CORPOSs.
- **Sensitivity to and ability to identify local interests and needs :** The ability of the school to identify local interests and needs is critical for facilitating the selection of SSIs that are relevant and have impact on the reality of the whole community. This entails openness and flexibility of the school to address the changing socio-scientific and environmental issues that confront the community and may be raised by the school community stakeholders. This capacity is crucial also for the ongoing involvement of the community in identifying issues the school should incorporate within its educational efforts
- **Identifying relevant stakeholders for the school context :** Collaborations with the community seem more sustainable when there is a clear profit for both community stakeholder and the school. Mutual engagement as part of CORPOS has facilitated a joint way of working together and of the opportunity to get to know each other better and to feel more confident to initiate further collaborations.
- **Motivated teachers :** Teachers who are committed to students' welfare and community involvement significantly drive CORPOS' initiatives. Identifying and supporting such teachers is key for continuity.
- **Anchoring in the schools' vision :** Some teachers indicated the importance of the CORPOS should be discussed and implemented in the vision of their school to make it sustainable.

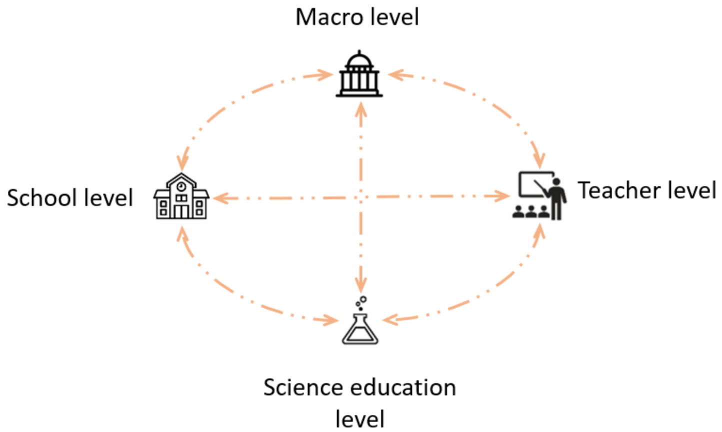
Barriers towards sustainable and viable CORPOS Open Schooling teams

- **Time constraints :** The lack of time, as teachers often had busy schedules that made planning and executing different activities difficult.
- **Rigid curriculum requirements and evaluation methods :** Rigid curriculum requirements and standardized testing also limited the flexibility needed for CORPOS, complicating the integration of innovative projects.
- **Lack of parental involvement :** Increasing efforts to engage parents and caregivers in the educational process could have provided additional support and highlighted the importance of these initiatives.
- **Staff turnover :** The absence of key teachers who were central to mobilizing and connecting projects posed a significant barrier. Ensuring a strong community of practice that could withstand the departure of key members was crucial. Promoting shared leadership and distributed responsibilities among all teachers could help maintain continuity and resilience in CORPOS' initiatives.

3. Part B – Empirical support for COSMOS framework – School openness dimensions

In this part, we start from the gathered data during the COSMOS project to enrichen the ecological model of school openness as proposed in the framework of WP2 (COSMOS, 2024).

The ecological model of school openness (Sarid et al., 2024) touches on different, interconnected, levels in education. Opening up schools touches on processes at macro level (high level governmental education policies), school level, the level of science education and the level of individual teachers that aim to implement SSIBL-CoP projects within their education. In this Part B of the report, we present those barriers and facilitators that membes of the open schooling teams that have implemented SSIBL-CoP in concrete project, identify as playing out at those four different levels. To present at which level a barriers or facilitators has been identified, we use icons to represent the levels.



The insights presented in this part B of the deliverable are drawn focus group discussion with member of the CoPs that have contributed to the implementation of SSIBL-CoP project in their science education, both in implementation round 1 and implementation round 2. Two main sources have been use to identify barries and facilitators at the four levels described above. One of these is the focus group discussions were held during the prepartion phase. At this time, CoP members reflected on the eight dimensions of schools opennes to position their school on each of them. Part of this were reflections barriers and faciltators that they felt would play out if their school were to make an outward movement for each of the eight school openness dimensions respectively. They also identified one or two of these dimensions that they felt their participation in COSMOS could facilitate an outward movement on (e.g. more and more diverse collaboration with communities arournd the school, more meaningfull parental participation…). Later, as part of the finalisation of the implementation fase, focus group were organized again, and CoP members reflected on the outward movements that were achieved and which barriers and facilitators influenced these shifts.

*The results presented here are a **reflection of an initial data analysis**. These findings should be considered as preliminary and are ment to feed our understanding of the barriers and facilitators to implementing open schooling. They are based on the experience of CoP members, and are therefore the perceived barriers and facilitators of those stakeholders that cooperated in the implementation of SSIBL-CoP project dyring the COSMOS project. Further investigation is needed to validate and expand upon the conclusions presented here.They can inspire education actors that aim to support schools and teachers in their effort to open up schools to their communities.*

3.1 Shared Governance

Shared Governance concerns the extent to which leadership is shared throughout the school organization and decision-making processes (Hallinger & Heck, 2010; Leithwood et al, 2009). It is a continuum ranging from more centralized to radically collaborative forms of governance. The participants of COSMOS identify barriers and facilitators towards a more open school organization in relationship within seven different aspects of Shared Governance: teacher autonomy, leadership style, organizational structure, organizational culture, teacher identity, teacher professional development & and staff turnover (Figure 12).

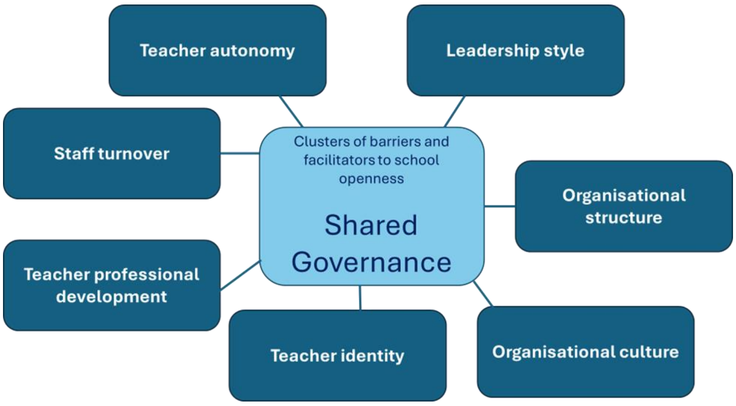


***Figure** 12.* Clusters of barriers and facilitators to school openness regarding School Governance

3.1.1 Teacher autonomy

Teacher autonomy refers to the professional independence and freedom teachers have in making decisions about various aspects of their work. An example quote of participants in COSMOS that illustrates teacher autonomy as a barrier or facilitator is:

> *"We are in a school group that allows this. We do not have a common evaluation, or when we do, we have evaluation elements. Teachers are independent in the evaluation we do of students." (P2D2).*

Barriers	Facilitators
Strict requirements from the government limit the freedom of the individual teacher.	A self-managing team supports shared governance by creating a collaborative environment where teachers have more control over their work and decision-making processes within a supportive, team-based framework.
Having a national exam for sciences gives teacher less freedom in their teaching and in providing more freedom for students.	The sense of autonomy of a teachers to decide themselves about their teaching empowers teachers towards shared governance.
Presence of an umbrella organisation of which decision-making processes are not transparent.	The school allows independent evaluation within a structured program.

3.1.2 Leadership style

A leadership style refers to the approach and behaviors a school leader uses to guide, influence, and manage educators, students, and school staff. An example quote of participants in COSMOS that illustrates leadership style as a barrier or facilitator is:

> *"In this school group, it was easy, the principal, despite having many responsibilities, is sensitive to these matters and allowed us to proceed. We then worked in partnership." (P2D2)*

Barriers

- The leadership is not listening to staff feedback on school-wide issues (e.g. behaviour).
- Principal having a hard time letting go. He's afraid of losing control.
- Leadership approach acts as a barrier to developing inner school communities.
- Teachers do not feel supported and are often not facilitated by the management when trying to make changes to the curriculum.

Facilitators

- The principal encourages individuality in teachers.
- The supportive leadership of the school director facilitated shared governance by allowing and encouraging collaborative projects within the school.
- School leadership is open to suggestions and changes made by subject leads.

3.1.3 Organizational structure

The organizational structure of a school defines the way roles, responsibilities, and authority are arranged and coordinated to achieve the school's educational goals. An example quote of participants in COSMOS that illustrates organizational structure as a barrier or facilitator is:

> *"The management and coordination are in the hands of one person, but everyone manages their own audience and work. [...] It relies on each person's competencies and mutual support." (P2B2)*

Barriers

- Different power structures within the school organization delaying decisions.
- Too rapid succession of different decisions.
- Physical presence of the management on campus.

Facilitators

- The presence of a participation council in which teachers have a seat.
- The occurrence of events for teachers to share their opinion about organizational ideas.
- The empowerment of students and parents as active participants in school governance increases their sense of agency and effectiveness in initiating changes.

Organizational routine of a weekly assembly about decision making supports shared governance.

The operation of inner school communities that is structurally embedded in the organization.

Horizontal organizational structure of the school working in units designing the curriculum.

Each teacher takes the lead on a subject (e.g., History, Science etc.) and leads on how the curriculum will be shaped in this subject.

Physical absence of the management on campus.

3.1.4 Organizational culture

The organizational culture is the set of shared beliefs, values, norms, and practices that shape the behavior, attitudes, and interactions of all members within the school community, including teachers, students, administrators, and staff. An example quote of participants in COSMOS that illustrates organizational culture as a barrier or facilitator is:

> *"We used to be quite...you used to be able to, you know, know the other departments, but we've become...a little bit over...divide and conquer, that kind of set up departments against each other at one point wasn't it, and let them fight and fall out and then see how we get on." (U1B1)*

Barriers

A habit in a school of checking everything with the principal, as a part of the school culture.

Competitiveness within schools and departments does not allow for sharing and collaboration to develop.

Competitiveness between schools due to the 'insular nature' of school governance at a national level.

Facilitators

No facilitators mentioned by CoP members

3.1.5 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment. An example quote of participants in COSMOS that illustrates Teacher identity a barrier or facilitator is:

"I'm having to work a lot harder because I am not teaching what I've been given… But I don't feel that I have, like you said, that there's the openness to go and say to somebody, 'This is not fit for purpose'. I've got to be honest, I don't feel that I can do that." (U2D1)

Barriers

Lack of guts to take responsibility for final decision from team members.

Teachers not feeling confident sharing issues with school leadership.

Not all teachers are open to try out new things and innovate, even if leadership supports innovation.

The belief that to prevent projects moving in many directions, direction needs to come from one person.

Facilitators

No facilitators mentioned by CoP members

3.1.6 Teacher professional development

Teacher professional development refers to the ongoing process through which teachers acquire new knowledge, skills, and competencies to improve their teaching practices and enhance student learning outcomes. An example quote of participants in COSMOS that illustrates Teacher professional development a barrier or facilitator is:

"We have to do this project now [for CPD]… There's been no evaluation or feedback from staff as to the use of it, the purpose of it, whether they're going to continue implementing what they trialed, nothing. And yet we're doing it again this year." (U2D1)

Barriers

Leadership not providing meaningful feedback on professional development activities.

Facilitators

Leadership engages teachers in continued professional development (CPD) initiatives.

3.1.7 Staff turnover

Staff turnover refers to the rate at which employees, teachers or policy members, leave an organization and are replaced by new hires within a specific time frame.

Barriers

The management team is new, it's not clear what to expect from this team.

Facilitators

Staff turnover acts as a facilitator to giving staff at department level more decision-making power when it comes to subject-specific areas such as assessment.

3.2 Open Curriculum

Open Curriculum concerns the extent to which school curriculum is adaptive, flexible and accessible to emergent and ongoing changes, as opposed to a fixed or rigid curriculum that is primarily pre-designed and rarely altered to meet changing interests or needs. It refers to the extent that the structure and content of learning subjects and the topics within these subjects are open to renegotiation, reorganisation, and innovation. The participants of COSMOS identify barriers and facilitators towards a more open school organization in relationship within eight different aspects of Open Curriculum: teacher identity, teacher autonomy, leadership style, collaboration, professional development, innovativity, governmental policy & organizational structure (Figure 13).

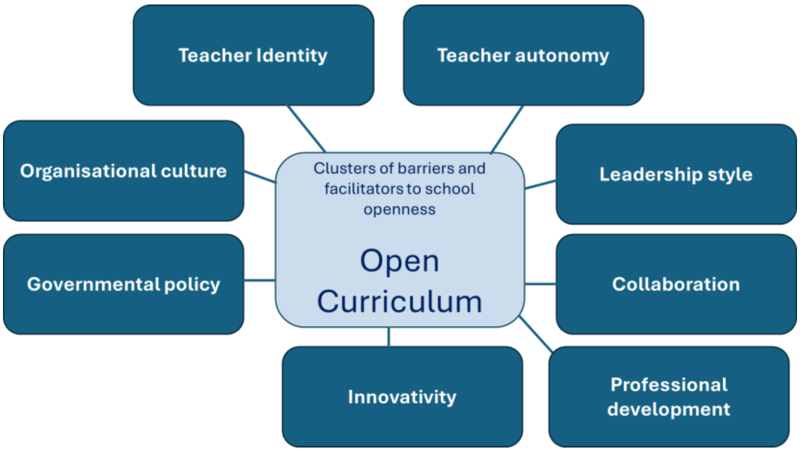


***Figure** 13.* Clusters of barriers and facilitators to school openness regarding Open Curriculum

3.2.1 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment.

Barriers

- Tension between conservation-minded and change-minded teachers in a team.
- The fear of innovation – especially digital innovations.
- The fear of being self-critical.
- The fear of increased work or time pressure.

Facilitators

- Teachers have the willingness to take on new approaches and to autonomously plan the subjects they lead.
- The creativity of a teacher
- Teachers who are open to change.

3.2.2 Teacher autonomy

Teacher autonomy refers to the professional independence and freedom teachers have in making decisions about various aspects of their work. An example quote of participants in COSMOS that illustrates teacher autonomy as a barrier or facilitator is:

> *"I think it is hard to be fixed in the way I teach, as it's not my nature." (U2A2)*

Barriers

- School seeks consistency in how teaching and learning appears, to adhere to the external education regulator.

Facilitators

- Teachers design their own lessons and programs.
- National curriculum doesn't decide how to teach. It is up to teachers to decide on this.
- Content of education is regulated. In this regard education is equal for all.
- Contentwise, there is room for teachers' and students' input.

3.2.3 Leadership style

A leadership style refers to the approach and behaviors a school leader uses to guide, influence, and manage educators, students, and school staff.

Barriers

- Decisions are no longer taken bottom-up but top-down.
- Teachers do not feel supported and are often not facilitated by the management when trying to make changes to the curriculum.
- The school management team has not yet decided on which direction they would like to go.

Facilitators

- School leadership encourages individuality in teachers.
- The backbone of the management team is to never undertake a one-time project.
- Pedagogical innovations are introduced by school leadership in areas not impacted by national policies.
- Principal is open and flexible to last-minute changes in the curriculum.

3.2.4 Collaboration

Collaboration refers to the process where students, teachers, administrators, or other stakeholders work together toward a common goal or purpose.

Barriers

Working in horizontal units reduces contact with subject matter colleagues, resulting in less discussion on content knowledge and less getting inspired.

Facilitators

Working collaboratively on trialing new approaches within their classrooms.

Shortened teaching timetable to accommodate weekly design sessions with colleagues.

School being part of an academy trust allows for across-school collaboration to develop the science curriculum

3.2.5 Teacher professional development

Teacher professional development refers to the ongoing process through which teachers acquire new knowledge, skills, and competencies to improve their teaching practices and enhance student learning outcomes.

Barriers

No barriers mentioned by CoP members.

Facilitators

Working collaboratively on teacher professional development.

Embedded time (e.g. Weekly afternoon sessions, educational development weeks) for educational development with colleagues.

Professional development initiatives within the school, such as peer observations, allow teachers to be more reflective.

3.2.6 Innovativity

Innovativity refers to the ability and willingness to introduce and implement new ideas, approaches, or methods that enhance learning, teaching, or school operations. An example quote of participants in COSMOS that illustrates innovativity as a barrier or facilitator is:

> *"It wasn't that much effort to sort of change things around because actually we were following a fairly similar structure to a certain extent with so much basis on questioning" (U2C2)*

Barriers

No barriers mentioned by CoP members.

Facilitators

The belief that emphasizing project-based learning and investigation methodologies over traditional exam-focused teaching can develop crucial transversal skills in students.

The belief that a particular change will not require too much extra effort on the part of the teacher.

Pilots are running to find out what changes in the curriculum can be beneficial to the school.

Diverse and rich curriculum (e.g., sports, arts) offers additional resources for facilitating collaborative settings.

A project demonstrating how standard educational resources can be used creatively to enhance experiential learning.

3.2.7 Governmental policy

Governmental policy in education refers to the set of rules, regulations, principles, and guidelines established by a government to guide and regulate the functioning, quality, and accessibility of education within a country or region. An example quote of participants in COSMOS that illustrates governmental policy as a barrier or facilitator is:

> *"It's so restricted in this country, isn't it? We're the most examined children in the world. We teach to pass a test in this country."* (U2D2)

Barriers

Curricular and examination restrictions

Facilitators

The situation when changes are imposed by the government.

The schools' proximity to government authorities.

3.2.8 Organizational culture

The organizational culture is the set of shared beliefs, values, norms, and practices that shape the behavior, attitudes, and interactions of all members within the school community, including teachers, students, administrators, and staff.

Barriers

No barriers mentioned

Facilitators

School climate of tolerance and mutual support allows for thinking "outside the box."

School and individual vision that breaks away from the vision of the Ministry of Education.

3.3 Inner School Communities

Inner School Communities refers to the extent to which organisational structures and routines operate in school that have an impact on school policy and decision-making. School organisational structures are composed of several participants that are engaged in the leadership, cultivation and development of certain aspects or themes pertaining to school curriculum and pedagogy. In most schools, leadership is distributed, to varying degrees, to various roles and positions constituting what is frequently termed 'middle or mid-level school leadership' (Gurr & Drysdale, 2013).The participants of COSMOS identify barriers and facilitators towards a more open school organization in relationship within six different aspects of Inner School Communities: organizational structure, leadership style, staff turnover, student engagement, organizational culture and collaboration (Figure 14).

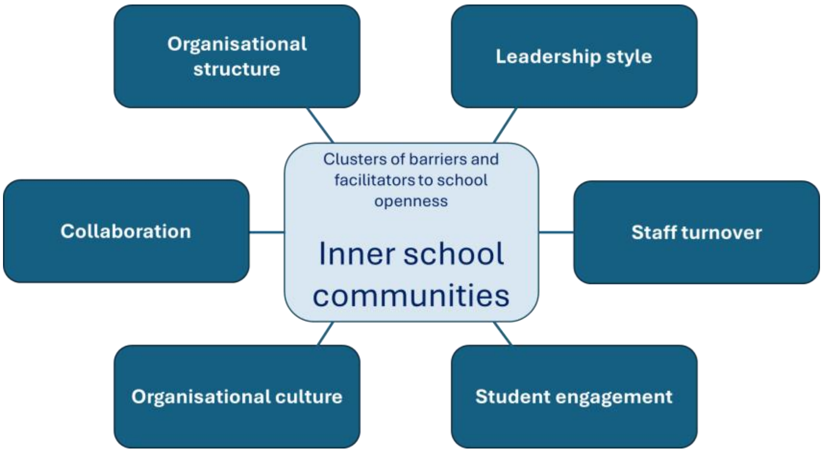


***Figure** 14*. Clusters of barriers and facilitators to school openness regarding Inner School Communities

3.3.1 Organisational structure

The organisational structure of a school defines the way roles, responsibilities, practicalities and authority are arranged and coordinated to achieve the school's educational goals.

Barriers

- A transition phase of a school leads to feelings of uncertainty for teachers.
- The lack of a restructured school system to support interdisciplinary projects

Facilitators

- The operation of inner school communities that is structurally embedded in the organization.
- Schools' structure allows for across-school collaboration between science coordinators.
- Embedded time (e.g. Weekly afternoon sessions, educational development weeks, shortened teaching hours) for collaboration with colleagues.
- Physical proximity facilitates daily communication.

3.3.2 Leadership style

A leadership style refers to the approach and behaviors a school leader uses to guide, influence, and manage educators, students, and school staff. An example quote of participants in COSMOS that illustrates leadership style as a barrier or facilitator is:

> *"The leadership has been missing. And the department just completely lacks direction at the moment" (U2D2).*

Barriers

School leadership doesn't encourage cross-departmental collaborations.

Department leadership lacking consistent direction and a vision.

Support for peer learning and collaboration is not offered, but needs to be asked for.

Facilitators

Schools' governance allows for cross-school collaboration between science coordinators.

School leadership encourages teachers to work collaboratively.

3.3.3 Staff turnover

Staff turnover refers to the rate at which employees, teachers or policy members, leave an organization and are replaced by new hires within a specific time frame.

Barriers

High teacher mobility within the organisation.

High school staff turnover, including the loss of experienced staff.

Facilitators

No facilitators mentioned by CoP members.

3.3.4 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment. An example quote of participants in COSMOS that illustrates student engagement as a barrier or facilitator is:

> *"What I liked was that instead of just observing, they decided to join the other students in the school and see what they thought." (P2C2)*

Barriers

No barriers mentioned by CoP members..

Facilitators

Active student committees that are involved in various aspects of the school.

- Peer learning: younger students learning from older ones and the other way around.

3.3.5 Organisational culture

The organisational culture is the set of shared beliefs, values, norms, and practices that shape the behavior, attitudes, and interactions of all members within the school community, including teachers, students, administrators, and staff.

Barriers

- Teachers take it upon themselves to engage in peer observation but do so in a judgmental rather than supportive manner.
- The necessity of special teams is identified as not necessary.

Facilitators

- School ethos embraces collaboration as a facilitator.
- A supportive internal school community facilitated project implementation by fostering collaboration and motivation among teachers and students

3.3.6 Collaboration

Collaboration refers to the process where students, teachers, administrators, or other stakeholders work together toward a common goal or purpose. An example quote of participants in COSMOS that illustrates collaboration as a barrier or facilitator is:

> *"I get on really well with Geography and they will work with me and because I've been at this school [for a long time] I have those sort of relationships with them." (U2D1)*

Barriers

- Impact of pandemic
- Fragmentation and competition between departments
- Lack of time for collaboration within the science department or across departments

Facilitators

- Teachers are used to working together on projects.
- Common personal attributes and experience with other school staff
- Willingness of other departments to collaborate

3.4 Learning Communities

Learning Communities refers to the kind of pedagogy and teaching methods that are practised in schools. It is possible to identify several generic features (Brown & Campione, 1996): learning communities are learner or student-centred, are characterised by collaborative practices, deal with authentic (or real-world) tasks, and are emergent and experiential (constructivist). Learning communities are composed first and foremost by teachers (may be more than one) and learners but may involve continuous change in composition and membership (Wenger, 1998). The participants of COSMOS identify barriers and facilitators towards a more open school organization in relationship within seven different aspects of Learning Communities: organizational structure, pedagogy, engagement of the school community, innovativity, student engagement, collaboration and teacher identity (Figure 15).

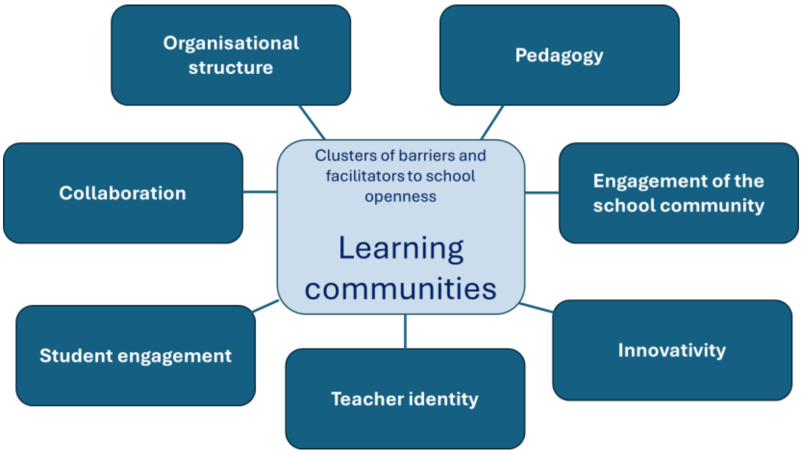


***Figure** 15*. Clusters of barriers and facilitators to school openness regarding Learning Communities

3.4.1 Organizational structure

The organizational structure of a school defines the way roles, responsibilities, practicalities and authority are arranged and coordinated to achieve the school's educational goals.

An example quote of participants in COSMOS that illustrates organizational structure as a barrier or facilitator is:

> *"Accountability is just at this school and they are absolutely paranoid...anything goes wrong, you're in trouble." (U2D2)*

Barriers

- Working in <u>isolation</u> from other schools.
- Influence of <u>pandemic</u>.
- <u>Risk assessment procedures and accountability</u> made teachers more reserved in reaching out:

Facilitators.

- <u>Formal learning communities</u> established in schools.
- <u>Organisational decisions</u> that facilitate implementation of new ways of working (e.g. class arrangement).
- <u>Afterschool clubs</u> offer space for learning communities to be created at schools.

3.4.2 Pedagogy

Pedagogy refers to the theory, practice, and methods of teaching and learning. It encompasses the principles, strategies, and techniques that educators use to facilitate learning and develop students' knowledge, skills, and critical thinking abilities. Pedagogy focuses on the interaction between teachers, students, and the educational content within a specific context.

Barriers

Inquiry-based learning (IBL)

- Teachers' lack of knowledge of and confidence in using inquiry-based learning.
- Teacher perceptions of inquiry as "discovery learning" focus on hands-on experimentation but lack concrete learning outcomes.
- Children don't know how to learn in an inquiry-based way because they are not taught to.

Primary school children's maturity and behavior present challenges to using inquiry.

Focus on individual learning (assessment) reduces opportunities for collaborative and inquiry-based learning.

Facilitators

Inquiry-based learning (IBL)

- School encourages inquiry-based learning.
- Subject matters that afford opportunities for inquiry-based learning (e.g. Science, History, and Geography).
- Lower year groups (secondary education) have more opportunities for inquiry-based learning.

Socio-scientific inquiry-based learning (SSIBL)

- Conducting new initiatives such as SSIBL pedagogy supports peer learning and leadership learning groups.
- Emphasizing action and hypothesis validation in science education fosters collaborative partnerships and practical implementation in learning communities.

3.4.3 Engagement of the school community

Engagement of the school community refers to the active involvement, participation, and collaboration of all stakeholders—including students, teachers, parents, administrators, and the wider community—in the educational process and activities of a school. This engagement fosters a sense of shared responsibility and partnership, creating a supportive and dynamic environment for learning and growth.

Barriers	Facilitators
No network or time to search for potential stakeholders.	Participation in projects related to local context.
Risk assessments and accountability concerns discourage outreach to community stakeholders.	Engagement with external organisations • Municipalities • Science departments • Museums

3.4.4 Innovativity

Innovativity refers to the ability and willingness to introduce and implement new ideas, approaches, or methods that enhance learning, teaching, or school operations. An example quote of participants in COSMOS that illustrates innovativity as a barrier or facilitator is:

> *"The core practicals are laid out for them, there's no real investigation involved, is there? It's, 'Do this, then do that, get some results." (U1B2)*

Barriers	Facilitators
Centralised, content-heavy curriculum with an exam-oriented approach reduces time for collaborative and inquiry-based learning.	Teachers focus on the long-term process of change.
Science and mathematics are often taught in traditional ways.	

3.4.5 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment.

Barriers	Facilitators
Some students resist peer learning.	Learning from people other than their teacher, such as fellow pupils, is motivating.
Students choose elective courses based on friends rather than interest in the subject.	Students in leadership roles inspire their peers.
Lack of student maturity and mindset to engage in inquiry-based learning.	Teachers organize events such as science fairs where students showcase their work.

3.4.6 Collaboration

Collaboration refers to the process where students, teachers, administrators, or other stakeholders work together toward a common goal or purpose.

Barriers	Facilitators
Lack of collaborative culture within the school.	External project members searching for potential societal partners, sometimes making first contact or facilitating meetings.
Dependence on individual teacher beliefs for fostering collaboration.	Active networking among teachers via WhatsApp.
Collaborative culture depends on individual teacher beliefs and willingness.	Teachers' collaborative working culture.

3.4.7 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment.

Barriers	Facilitators
Fear of being self-critical prevents innovation.	Teachers' willingness to collaborate, influenced by personal dynamics and leadership
Teachers' beliefs and perceptions about assessment and change are unsupportive of new approaches.	Teachers' identity and personal experience influence their engagement in learning communities
Younger/Less experienced teachers are less confident about deviating from traditional methods ("by the book").	

3.5 Student Participation

'Student participation' refers to the diverse ways in which students can be actively involved in learning, school organisation and school-related activities. The participants of COSMOS identify barriers and facilitators towards a more open school organisation in relationship within nine different aspects of Student Participation: organisational structure, teacher identity, peer learning, student engagement, engagement of the school community, leadership style, student autonomy, parental involvement and pedagogy (Figure 16).

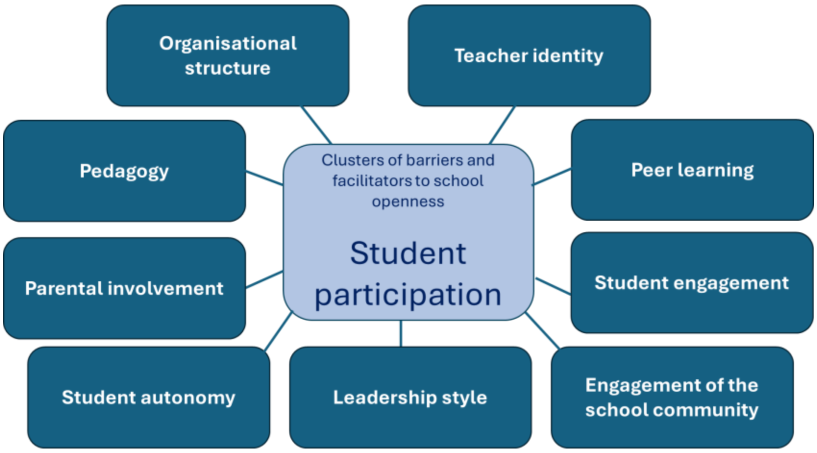


Figure** 16. Clusters of barriers and facilitators to school openness regarding Student Participation

3.5.1 Organisational structure

The organisational structure of a school defines the way roles, responsibilities, practicalities and authority are arranged and coordinated to achieve the school's educational goals.

Barriers

- Exams-focused and content-focused educational system eliminates alternative forms of assessment fostering autonomy and creativity
- Teacher-centered curriculum
- Extensive, overcrowded curriculum
- Clashes among students' class schedules impede peer learning and mentoring.
- Pandemic halted structures like student councils.

Facilitators

- Availability of a student board/council.
- Participation in project days together with other schools to boost school functioning towards the organisation of a student board.
- Open relations between students, teachers, and principal

3.5.2 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment.

An example quote of participants in COSMOS that illustrates teacher identity as a barrier or facilitator is:

> *"I want to work like this a lot more! Mainly because I noticed what a positive effect it had on the students." (S2D2)*

Barriers

- Teachers' control of what is taught due to curriculum constraints
- Teachers feel students lack the confidence and voice to express their ideas and opinions.
- Teachers perceive students' behavior as a challenge when using open and creative teaching approaches.

Facilitators

- Teachers' openness to students' contributions and suggestions.
- Teachers give room for student feedback, questions, and adapted lessons based on formative assessments
- Behaving humanely as a teacher toward students, such as apologizing for mistakes and setting a good example.
- Responding to students' questions or interests during lessons.

3.5.3 Peer learning

Peer learning refers to a collaborative learning approach where students learn from and with each other, often by sharing knowledge, skills, or experiences.

Barriers

- Pandemic disrupted peer learning opportunities.
- Scheduling clashes impede peer learning and mentoring.

Facilitators

- Pedagogies allowed for peer learning and more pupil voice in classrooms.
- Students worked in small groups and engaged in collaborative problem-solving.
- Collaboration among students from different grade levels encouraged participation and engagement.

3.5.4 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment. An example quote of participants in COSMOS that illustrates student engagement as a barrier or facilitator is:

> *"Children will be so engaged in learning that they will take it off in different directions…but we need to do some work to get our children to be active participants." (U2C1)*

Barriers

Student apathy attributed to the pandemic and lack of independence training during lockdowns

Student low interest in science or other topics being taught.

Passive learning community where students don't actively participate

Facilitators

Students' motivation and attitudes are crucial to participation.

Personal relevance of projects fosters engagement.

Students' influence and participation opportunities increase with age.

3.5.5 Engagement of the school community

Engagement of the school community refers to the active involvement, participation, and collaboration of all stakeholders—including students, teachers, parents, administrators, and the wider community—in the educational process and activities of a school. This engagement fosters a sense of shared responsibility and partnership, creating a supportive and dynamic environment for learning and growth.

Barriers

No barriers mentioned.

Facilitators

Students engaged with local councils and external organizations during projects.

Teachers encourage projects that connect students with the community and real-world contexts.

3.5.6 Leadership style

A leadership style refers to the approach and behaviors a school leader uses to guide, influence, and manage educators, students, and school staff.

Barriers

Principals need to allocate more hours and tools for student participation initiatives.

Facilitators

The principal's vision of openness to innovative ideas proposed by students.

Leadership support for participatory structures like student boards fosters inclusion.

3.5.7 Student autonomy

Student autonomy in education refers to the degree to which students are given the freedom and responsibility to direct their own learning, make decisions about their educational experiences, and take ownership of their academic goals. An example quote of participants in COSMOS that illustrates student autonomy as a barrier or facilitator is:

"They felt empowered by the power they have as agents of change in small things." (P2D2)

Barriers

- Pandemic influencing children's learning journey across years, reducing opportunities to ask questions, inquire, or use different spaces at school.
- Students lack knowledge of action possibilities and don't know how to identify solutions.
- Lower-secondary students' age makes them less interested in school and influencing education.
- Students currently require "handholding" and are unaccustomed to having a voice.

Facilitators

- Students' self-evaluation and peer evaluation fostered reflection and responsibility.
- Students engaged in addressing school issues, such as creating 3D models and presenting solutions.
- Student participation in discussions with the local council empowered them as agents of change:

3.5.8 Parental involvement

Parental involvement in education refers to the active participation and engagement of parents or guardians in their child's educational experiences, both at school and at home.

Barriers

- Less learning opportunities at home.
- How school is valued at home impacts pupils' interest in learning and participation.

Facilitators

- Parents' support at home can enhance children's learning and participation.

3.5.9 Pedagogy

Pedagogy refers to the theory, practice, and methods of teaching and learning. It encompasses the principles, strategies, and techniques that educators use to facilitate learning and develop students' knowledge, skills, and critical thinking abilities. Pedagogy focuses on the interaction between teachers, students, and the educational content within a specific context. An example quote of participants in COSMOS that illustrates pedagogy as a barrier or facilitator is:

"We let the students choose the format they wanted [...] this is putting the student at the center of their learning." (P2B2)

Barriers

- Exams-focused curriculum discourages the use of alternative assessment methods that promote creativity and

Facilitators

- Pedagogical strategies like debates, group work, and flexible grouping facilitate participation.

pupil autonomy.	
Lack of time for teachers to plan and consider student participation extensively.	Use of formative and peer assessments during learning activities.
	Emphasis on personal inquiry and relevance in learning
	Practical, hands-on science activities motivate and encourage children to engage with learning.
	The project placed students at the center of learning by allowing autonomy in assignments

3.6 Parental Involvement

Parental Involvement is often conceptualised as multidimensional (Boonk et al., 2018). Generally speaking, it is thought to be aimed at improving children's achievement in schools, and this has two generic forms: parental home-based involvement and parental school-based involvement. Home-based involvement may include different ways to assist children with their homework and conducting conversations with them regarding their experiences in school; School-based involvement includes actively seeking meaningful relationships with teachers as this concerns their children's status and experiences in school. The participants of COSMOS identify barriers and facilitators towards a more open school organisation in relationship within seven different aspects of Parental Involvement: organisational structure, teacher identity, communication, school vision, student engagement and parental background (Figure 17).

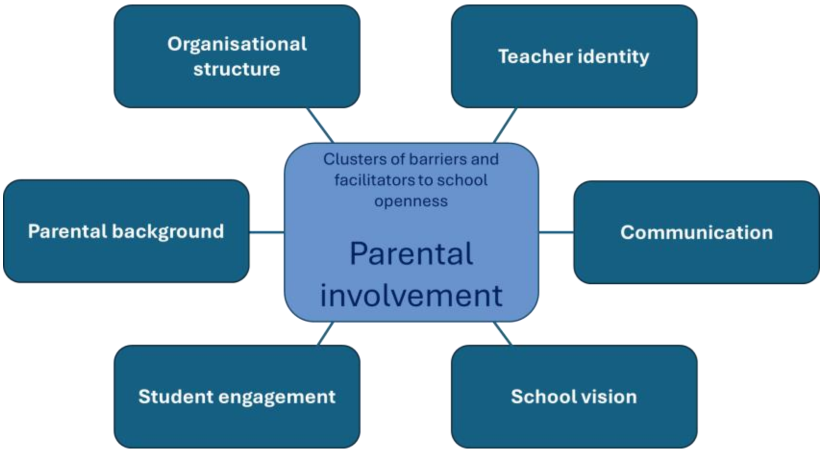


***Figure** 17.* Clusters of barriers and facilitators to school openness regarding Parental Involvement

3.6.1 Organizational structure

The organisational culture is the set of shared beliefs, values, norms, and practices that shape the behavior, attitudes, and interactions of all members within the school community, including teachers, students, administrators, and staff.

Barriers	Facilitators
School does not consult parents on new policies.	The presence of a participation council in which parents have a seat.
School approach to parental engagement limits interaction to reporting issues or praising students.	Organizing a working group to increase parent involvement.
Replication of the same parental involvement approach over years reduces parent buy-in and interest.	The presence of a parent board.
Larger student groups in secondary school mean teachers don't get to know pupils and their parents as well as in primary school.	Democratic process of electing parent committee membership promotes engagement.

Parents unavailable during learning hours, making participation difficult.

Lack of pedagogical strategies to effectively integrate parental involvement into teaching and learning activities.

Planning a series of events gives parents opportunities to arrange schedules and attend.

Positive influence of parent committees to manage disruptive parents and foster harmony.

Leadership initiatives (e.g., developing a strong parent group) increase engagement.

Establishing organizational mechanisms for parents' positive contributions.

3.6.2 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment. An example quote of participants in COSMOS that illustrates teacher identity as a barrier or facilitator is:

"I hate parents – I admit. I also think that parents here want to be less involved." (I1A2)

Barriers

Negative teacher attitudes towards parents:

Teachers hesitant to involve parents due to parents' tendency to "take over."

Facilitators

Teachers recognize and respect parents' contributions.

Teachers with leadership roles actively engage parents in school-level initiatives:

3.6.3 Communication

Communication refers to the process of exchanging information, ideas, thoughts, and feelings between educators, students, other stakeholders and parents to facilitate learning and foster understanding.

Barriers

No barriers mentioned by CoP members.

Facilitators

Digital communication, such as newsletters, facilitates outreach.

3.6.4 School vision

A school vision is a clear and aspirational statement that outlines the long-term goals, values, and purpose of a school. It reflects the school's commitment to the academic, social, and personal development of its students and serves as a guiding principle for decision-making and planning. An example quote of participants in COSMOS that illustrates school vision as a barrier or facilitator is:

> *"It's not coming [from a] whole school [approach]...it's relying on individual teachers, and when those teachers go, it just goes with them." (U2D1)*

Barriers

- Schools lack openness to parental involvement.
- Schools fail to engage parents positively and meaningfully.
- Parental involvement depends on individual teachers' initiatives rather than a whole-school approach

Facilitators

- Establishing organizational mechanisms for parents' positive contributions.
- The school's vision emphasizes shared responsibility between parents, school, and students.

3.6.5 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment.

Barriers

- Parents' absence in students' lives affects their participation in education.
- Children's reduced interest in parental involvement as they grow older further limits engagement.
- Students' legal age to make decisions independently reduces parental involvement.

Facilitators

- Students took projects home, and parents supported by asking questions and providing permissions.
- Parents' engagement with students' activities increases motivation and interest in learning.

3.6.6 Parental background

Parental background in education refers to the socioeconomic, educational, cultural, and demographic characteristics of a student's parents or guardians that influence the student's educational experiences, opportunities, and outcomes. An example quote of participants in COSMOS that illustrates parental background as a barrier or facilitator is:

> *"A lot of our parents have never had a good experience as children and haven't had a good experience of school as parents." (U2C2)*

Barriers

- Negative parental attitudes obstruct productive collaboration in leadership roles.

Facilitators

- Parents' professional background in science (e.g., scientists, engineers, STEM ambassadors) supports projects.

Parents don't want to be involved.

Negative parental attitudes towards schooling due to their own experiences.

Cultural differences lead to varied views on parents' and schools' roles.

Language barriers prevent effective communication.

Parents in working-class/low SES areas are often in full-time employment and unable to attend school events.

Parents' attitudes towards engagement are passive: they show up to events but do not actively participate.

Communication style doesn't suit the parents.

Digital communication like newsletters is one-way and does not foster engagement.

Lack of competence in science among parents limits their ability to engage.

Parents' low understanding of school concepts and pedagogical strategies (e.g., science pedagogy) reduces their capacity to support their children's learning.

Parental involvement as experts during lessons (e.g., architects assisting with models).

Parents contributed materials and assistance for projects.

Parents help create opportunities for student collaboration and experiential learning.

Engaging parents in projects builds bridges between home and school learning environments.

Positive experiences of parents with the school lower the threshold for further involvement.

Transparency about school rules and procedures builds trust and engagement.

Communicating to parents that their children's best interest is the school's aim fosters alignment.

Parental involvement facilitated through satisfaction surveys.

3.7 Social Engagement

Social Engagement concerns the school's active participation in addressing community needs and problems and working toward the community's development and well-being. Similar to other concepts such as 'service learning' and 'community-learning' (Dryfoos, 2000; Heers et al., 2016), 'social engagement' takes place when schools participate in activities for the community, such as aiding special needs children, addressing issues of marginalisation and discrimination (i.e., inclusion), promoting environmental sustainability, assisting senior citizens, and connecting learning to issues concerning the community and the betterment of society at large. The participants of COSMOS identify barriers and facilitators towards a more open school organisation in relationship within five different aspects of Social Engagement: teacher identity, student engagement, pedagogical vision, inclusivity of the school and community partnerships (Figure 18).

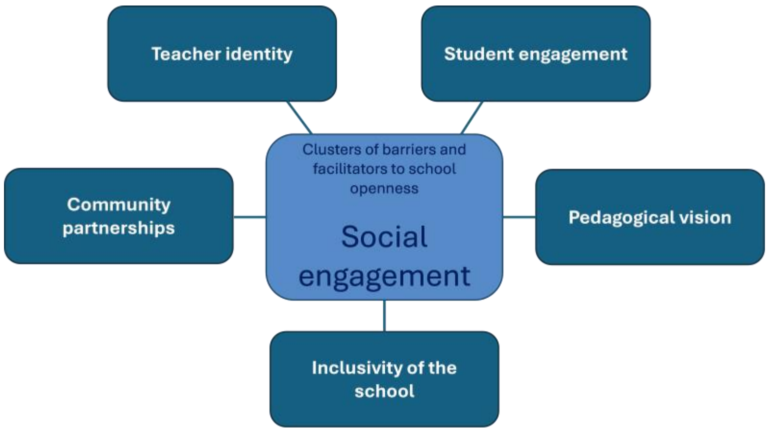


***Figure** 18.* Clusters of barriers and facilitators to school openness regarding Social Engagement

3.7.1 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment.

Barriers	**Facilitators**
Disciplinary teachers are less involved in science education: Highlights a gap in teacher engagement.	Personal conviction of teacher about the importance of social engagement.
No time to research for or plan additional learning schemes for disadvantaged pupils: Reflects workload challenges for teachers.	Having a teacher who has professional knowledge and experience around the socio-scientific issue (e.g., dietician) provides a built-in foundation for expanding socially oriented learning projects.
The pandemic limited teacher initiatives and cross-departmental learning.	Teacher personal attributes and experience support collaboration across departments.

High staff turnover, including the loss of very experienced staff: Disrupts teacher stability and their role in initiatives.

Too many social problems to handle with students at school because of different kinds of needs or student backgrounds: Teacher struggles in addressing diverse needs.

No opportunities to work in teams: Lack of collaboration affects the ability to implement socially engaging projects.

Teachers' only events for team building.

Special Educational Needs Coordinator allows for engagement with social issues affecting the school

3.7.2 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment.

Barriers

No provision to engage pupils that are 'in-between' (not disadvantaged based on government criteria but still coming from underprivileged backgrounds or just not engaged with their learning): Highlights a gap in addressing these students' needs.

One project was not graded and in a not-regular week of school resulting in lack of interest or feeling of urgency by some students: Indicates the importance of proper framing for student motivation

Exam-oriented education system nationally: Limits time and emphasis on broader, socially engaging activities for students.

Student engagement was affected by shifting school priorities during the pandemic.

Facilitators

Students' motivation.

Students' social engagement involved them in practical activities to improve their school environment, fostering a sense of community responsibility.

Inclusive co-design process means that all children could access the activities.

Embedded in tutor time and Personal, Social, Health Education curriculum.

3.7.3 Pedagogical vision

The pedagogical vision is a comprehensive and forward-looking statement that outlines the school's approach to teaching and learning. It reflects the school's philosophy, values, and goals regarding education and serves as a framework for instructional strategies, curriculum design, and classroom practices.

Barriers

Lack of accessibility of knowledge and information shared on socially disadvantaged children makes using more inclusive teaching and learning practices a challenge.

Facilitators

The school's pedagogical vision emphasizing the importance of the social-emotional development of students attracts teachers with a similar vision.

Citizenship education is part of the school's aim.

Availability of accessible, authentic internet sources to research various perspectives of stakeholders.

Government policy drives attention to the importance of social engagement.

3.7.4 Inclusivity of the school

Inclusivity of a school refers to the practice of creating a welcoming, supportive, and equitable environment where all students, regardless of their background, abilities, identities, or circumstances, have access to quality education and opportunities to thrive. It involves embracing diversity and ensuring that every student feels valued, respected, and included in all aspects of school life.

Barriers

Focus on immediate challenges over broader engagement.

Facilitators

The school is open to change; there is a willingness to accept everyone as they are."

School initiatives that promote equity, diversity, and inclusion, such as students coming into school in costumes representing their ethnic background, religion, or nationality.

School organizational structures such as a hands-on Special Educational Needs Coordinator facilitate engagement with social issues.

Someone appointed as a liaison officer between the school and the local community.

Organizational structures such as a family support officer support the school being outward-facing in this dimension.

Leadership team driving support for vulnerable families.

3.7.5 Community partnerships

Community partnerships refer to collaborative relationships between schools and various community stakeholders, such as businesses, nonprofit organizations, government agencies, and local residents, to enhance educational experiences and outcomes. These partnerships aim to leverage community resources, expertise, and support to address the needs of students, schools, and the wider community.

Barriers

- Excessive bureaucracy for partnerships: Administrative hurdles impact partnerships.
- Pandemic impact: Collaborative practices have been eroded by external factors.

Facilitators

- Collaboration with local partners.
- Partner schools in other (less developed) countries.
- School partnership with community center, which offers support to underprivileged pupils

3.8 Community Collaborations

Community Collaborations refers to the extent to which school engages in collaboration with community stakeholders and other social actors such as public services, science centres, local businesses, museums, higher education institutions. The community collaborations continuum incorporates both the extent (i.e., who participates and how frequently) and the depth of the relationships that are fostered by the school.

The participants of COSMOS identify barriers and facilitators towards a more open school organisation in relationship within eight different aspects of Community Collaborations: organisational structure, leadership style, teacher identity, student engagement, parental involvement, peer learning, stakeholder engagement and pedagogy (Figure 19).

Figure *19*. Clusters of barriers and facilitators to school openness regarding Community Collaborations

3.8.1 Organisational structure

The organisational structure of a school defines the way roles, responsibilities, practicalities and authority are arranged and coordinated to achieve the school's educational goals.

Barriers

- Lack of physical and human resources/infrastructure.
- Cost of living crisis limits participation in initiatives requiring payments.

Facilitators

- Strong existing relationships with community stakeholders.
- School's organizational structure as part of an academy trust facilitates collaboration with other schools.
- Several initiatives across subjects at the school level linked to social engagement.
- Collaboration with local authorities for supervision and cost regulation reduces teacher workload and enhances project feasibility.

City Council and local organizations provide logistical resources.

3.8.2 Leadership style

A leadership style refers to the approach and behaviors a school leader uses to guide, influence, and manage educators, students, and school staff.

Barriers

- Setting up collaborations is not facilitated by the management.

Facilitators

- School leadership teams are open to community collaborations:

3.8.3 Teacher identity

Teacher identity refers to the way teachers perceive and define themselves in their professional role, shaped by their values, beliefs, experiences, and interactions within the educational environment.

Barriers

- Teachers feel collaborations may be a waste of time.
- Teachers guiding students during the day felt embarrassed by some students' lack of interest in front of stakeholders.
- Instability in staffing leads to loss of established community links.

Facilitators

- Teachers' view that they are open to collaborations.
- Teachers acknowledge their strengths and limitations and collaborate to address gaps:
- Teachers with attributes of openness and collaboration are seen as facilitators for community collaboration.

3.8.4 Student engagement

Student engagement in education refers to the degree of interest, motivation, attention, and active participation that students demonstrate in the learning process. It encompasses their emotional, behavioral, and cognitive involvement in academic activities and the school environment. An example quote of participants in COSMOS that illustrates leadership style as a barrier or facilitator is:

"Younger students share their learning with families, sensitizing more people." (P2C2)

Barriers

- Students' lack of interest or feeling of urgency in participating in projects when they are ungraded or outside regular school schedules.
- Stakeholders' perceptions and apprehensions about working or interacting with school pupils, especially

Facilitators

- Projects related to the local context foster student and community engagement.
- The school motto emphasizes future citizenship and social engagement, aligning projects with real-world relevance.

concerning their behavior or engagement levels.

- Projects engaging younger students effectively extend the impact to families and the broader community.
- Learning from people other than teachers and peers is motivating for students.

3.8.5 Parental involvement

Parental involvement in education refers to the active participation and engagement of parents or guardians in their child's educational experiences, both at school and at home.

Barriers

- Reliance on parental funding for activities like field trips to community locations.

Facilitators

- Collaboration between teachers, parents, and students enhances community connections.
- Engaging parents' professional expertise in projects.

3.8.6 Peer learning

Peer learning refers to a collaborative learning approach where students, schools or teachers learn from and with each other, often by sharing knowledge, skills, or experiences.

Barriers

- Teachers feel disconnected from peers and stakeholders due to the lack of in-person networking opportunities.
- The pandemic stopped teachers from attending networking and meetings with teachers from other schools, reducing opportunities for collaboration.

Facilitators

- Participating in project days with other schools boosts collaboration and community engagement.

3.8.7 Stakeholder engagement

Stakeholder engagement refers to the process of actively involving individuals, groups, and organizations with an interest or role in the educational system in decision-making, planning, and implementation to improve outcomes for students and the community. Stakeholders include students, parents, teachers, administrators, policymakers, community members, and businesses.

Barriers

- Organizations not having programs adapted for students or not open to school visits.

Facilitators

- Stakeholders are motivated to collaborate due to mutual benefits.

Lack of willingness from professional stakeholders to collaborate unless their children study at the school.

Lack of contacts within local communities, especially in small municipalities.

Practicalities of initiating communication with stakeholders, including unresponsiveness to emails.

Ongoing advertising of school activities supports collaboration with stakeholders.

Continuously mapping the school's ecosystem facilitates collaborations with various organizations.

Organizing conferences and networking events raises awareness among stakeholders and encourages partnerships.

3.8.8 Pedagogy

Pedagogy refers to the theory, practice, and methods of teaching and learning. It encompasses the principles, strategies, and techniques that educators use to facilitate learning and develop students' knowledge, skills, and critical thinking abilities. Pedagogy focuses on the interaction between teachers, students, and the educational content within a specific context.

Barriers

No barriers mentioned by CoP members.

Facilitators

Field trips encourage external collaborations.

Whole-school events for sharing and discussing practices.

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Appendices

Appendix 1 – Manual – CORPOS/CoP focus groups

Appendix 2 – Manual – Student Survey

Appendix 3 – Student Survey

Appendix 4 – Manual – Student group interviews

Appendix 5 – Focus group scheme – Societal partners

COSMOS openness assessment

Partner manual version 12.06.2024

for use in the second implementation round

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Content

Disclaimer : *This manual is for use within the COSMOS consortium only. It is not to be circulated outside the consortium without a documented agreement of the COSMOS executive board. The manual serves to support the administration of the focus groups in the different partner countries during the second implementation round in academic year 2023-2024. All correspondence can be addressed to* *mart.doms@kdg.be*

1. Focus groups CORPOS

Objective – Assessing the school openness

Why?

- Describe the school openness at the start of the project
- Give direction to the guidance by collaboratively setting goals as a CORPOS (at the beginning of the initiation stage - link WP3-4-5)
- Describe changes in openness than can be attributed to COSMOS project (at the end of the implementation rounds)
- Determine barriers and facilitators to school openness, from the viewpoint of diverse stakeholders (at the end of the implementation rounds)
- Determine how COSMOS contributes to the process of teacher professional learning, and SSIBL teacher identity development
- Determine the critical factors that facilitate or impede SSIBL-CoP implementation in ths COSMOS schools
- Determine barriers and facilitators to install viable and sustainable CORPOSs in schools

When?

- At the beginning of the initiation stages (round 1 – round 2 only for new schools) and at the end of the implementations
- Suggested timeframe :
    - At the **beginning of the initiation stage**: second half the first month of the school year (so e.g. in Flanders : September)
    - At the **end of the implementation round:** after the school itself considers the SSIBL-COP implementation to be complete, and before the end of the school year.

Who?

- The CORPOS/CoP membership 'as is' at the moment of administration:
    - *Mandatory* : the teachers of the classes that implement(ed) the SSIBL-CoP
    - *Optional* : school leader, but only if that does not compromise the psychological safety of the other participants (to be decided for each school)
    - *Preferential* : other CORPOS members (students, parents, SMEs, non-formal science learning centers, local policymakers …)
- The focus group is led by the a member from consortium (HEI and/or SP), depending on local context

Where?

- Ideally at the school in a quiet room; e.g. the science room
- Try to avoid online administration

Guidelines

- The focus can but does not need to be a stand alone. It can be part of the introductory meeting and evaluation meeting with the CORPOS members, depending on what makes most sense in your context.
- The result of the focus group is not normative. It situates the school & the science education on a continuum from low openness to high openness, with room for differences regarding the different dimensions. We do not label that as good or bad.
- CORPOS members are invited to reflect on and speak of the school's current daily reality, not from a future, desired situation.
- You, as member of the HEI, are part of the CORPOS. It is therefore permitted to share your own experiences and impressions and check them with the rest of the focus group.
- There are different organizational levels in which openness can manifest itself. In the COSMOS project we start the conversation & the coding process bottom-up, as this reflects our primary interests:

  1) Start at the teacher / science education level;

  2) Ask for (possible) influence on the school level or school as a whole.

2. Data Collection

2.1 Near the start of the initiation stage

Equipment

- Short PowerPoint presentation on the 8 dimensions of school openness
    - Presentation must be translated by the HEI partner itself
- Pencils or markers for each participant: one color for the teacher/science education level & one color for the school level
- Visualisation of school openness dimensions (A4) for each participant: Annex 1

    The translation of the visualisation will be provided by WP 7 (in collaboration with WP 8)
- Visualisation school openness dimensions (A3) for the focus group facilitator: Annex 1
- Audio recording material.

Guidelines pre focus group – see Annex 2

2.2 Near the end of the implementation round

Equipment

- PowerPoint slide – visualisation of SSIBL-CoP
- Visualisation school openness dimensions (A3) for the focus group facilitator: Annex 1
- Pencil or marker for the focus group facilitator: one color for the teacher/science education level & one color for the school level
- Audio recording material

Guideline post focus group – see Annex 3

3. Data analysis

Data

- Transcription of the audio recording of the focus group
- Visualisation school openness of the school at the end of the focus group of the initiation stage

Data analysis

Questions	Answers from	
	Pre focus group	Post focus group
Understanding facilitators and barriers to the school openness attributes ➢ What do members of the CORPOS report in terms of facilitators and barriers relating to openness attributes at their school? Results to be delivered at KdG ⇨ **Facilitators – Barriers**: List with short description (keep it as concise as possible) per attribute o Length of list does not matter. o If item occurs more than once, list for all attributes. o At the level of science education & at the school level	x	x
COSMOS contribution **1.1 Openness :** How did COSMOS contribute to moving from inward to outward? (narrative) **1.2 Teacher identity :** How did COSMOS contribute to the process of teacher professional learning, and SSIBL teacher identity development? (narrative)		X (achieving goals) X
Facilitators and barriers in implementing SSIBL-CoP in schools 2. Which are the critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools? (narrative)		X (achieving goals)
Sustainability & viability of the project 3. Which are the critical factors that facilitate or impede viable and sustainable CORPOSs in schools? (narrative)		X (achieving goals)

How?

- To answer these questions we need to code and query the transcripts of the focus groups.

- Coding will be at group level, i.e. we are not coding on individual participant level in the transcript.
- A horizontal code (attribute) should not always be combined with a vertical one (inward – outward – barrier – facilitator – change).
- A vertical code (barrier – facilitator – change) does need to be combined with a horizontal one (attribute). Thus coding a barrier, facilitator, change or examples can only happen in combination with at least one attribute
- One item can be coded under different attributes (e.g. exemplifying multiple openness dimensions).
- Tip! It might help to use the PowerPoint of the focus groups while coding. The description of the attributes and the statements can support the coding process.
- There are different coding levels of importance in the focus group. We choose to start the coding process bottom-up.
  1) Rationale: code at the teacher / science education level;
  2) If applicable, code on the school level or school as a whole (if so, use the code 'School level')

What does WP7 provide for to the HEI in the COSMOS consortium?

- Codebook with brief descriptions (Word & .qdc)
  - Deductive coding with provided codes
  - Inductive coding : room for additional 'local' codes
- Queries that can be used to delve for answers in the transcripts
- A template for your national report of the focus group (initiation stage – post implementation) – Annex 4 (initiation stage) & 5 (post implementation)
- A template for the report of the focus group at individual school level (initiation stage – post implementation) – Annex 6 (initiation stage) & 7 (post implementation)

What do teams send back to us?

As stipulated in the COSMOS data management plan and in the data sharing agreements between KdG and all individual HEI partners, qualitative data is not shared. It is up to the HEI partners themselves to process the qualitative data and send their country specific results to KdG. KdG will then integrate these into D7.1.

Deadline

By Monday the 9th of September 2024 all results of the focus groups should be sent to KdG.

Codebook

Teacher Identity

Teacher Identity	TI		Examples of how COSMOS contributed to the process of teacher professional learning, and SSIBL teacher identity development

Horizontal : school openness attributes

Community collaborations	CC		The extent to which school engages in collaborations with the community and other social actors
Shared governance	SG		The extent to which school leadership is shared throughout the organisation and beyond
Curriculum	CU		Flexibility, frequency and extent to change of the school
Social engagement	SE		The extent of social commitment of the school community
Inner school communities	IC		The extent that inner school communities operate within schools and whether their functioning impacts school policy and decision-making
Learning communities	LC		The extent that learning communities are applied in schools as part of the school curriculum (Including inquiry-based learning)
Student participation	SP		The extent to which students are active, autonomous and self-determining in the learning process
Parental involvement	PI		The extent to which parents are engaged and involved, are able to make their voices heard and have an influence on learning, decision-making and various aspects relating to school processes and organization

Vertical : for each attribute

FACILITATOR of the attribute	FAC		A condition that makes the process towards a more open school (more) easy
BARRIER of the attribute	BAR		A condition that makes the process towards a more open school (more) difficult
CHANGE within the attribute	CHA		A change within the attribute during the COSMOS project
SCHOOL level	SCH		If the concretization/example given is formulated at the level of the school

Queries

Matrix coding query 1: Openness of the attributes – facilitators & barriers

Vertical (attributes)	**Horizontal (facilitators & barriers)**
Shared governance	Facilitators
Curriculum	Barriers
Social engagement	
Inner school communities	

Learning communities
Student participation
Parental involvement
Community collaborations

Matrix coding query 2: Openness of the attributes – COSMOS contribution

Vertical (attributes)	**Horizontal (openness)**
Shared governance	Change
Curriculum	
Social engagement	
Inner school communities	
Learning communities	
Student participation	
Parental involvement	
Community collaborations	

Reference codes for quotes

When including quotes, use a reference codes – 4 digits:

Country	P (Portugal) I (Israel) S (Sweden) N (the Netherlands) U (the United Kingdom) B (Belgium)
Round of implementation	1 (first implementation round) 2 (second implementation round)
School	A B C D (Provide each participating school from a code)
Pre – Post	1 (initiation stage) 2 (post implementation)

Data sharing

- See Data Management Plan:
  - Qualitative data are not shared among partners
  - Only results are shared.

Annex 1 – Visualisation school openness dimensions

Annex 2 – Guideline focus group at the initiation stage

Part	Content	Timing	Material
1	Short **introduction** to the 8 dimensions that together determine the dimensions of openness of the school • Shared governance • Curriculum • Social engagement • Inner school communities • Learning communities • Student participation • Parent involvement • Community collaborations	5’	Short PowerPoint presentation on the 8 dimensions: slide 1-3
2	**Individual assessment**: Each participant (individually!) fills in the visualisation of the school openness (Annex 1). We will guide them through the different dimensions and provide some time to point their science education on the continuum. • Shared governance (slide 4-6); • Curriculum (slide 7-9); • Social engagement (slide 10-12); • Inner school communities (slide 13-15); • Learning communities (slide 16-18); • Student participation (slide 19-21); • Parent involvement (slide 22-24) • Community collaborations (slide 25-27). ——— For each dimension of school openness: 1. Short definition of a dimension 2. Position their own science education at the arrow from inward to outward (color 1) Questions: • Do we do this a lot or a little within our science education? • To what extent does this characterize ‘our’ way of science teaching? 3. Position their own school at the arrow from inward to outward (color 2) Questions: • Do we do this a lot or a little within our science education? • To what extent does this characterize ‘our’ way of science teaching?	15’	Pencils or markers for each participant Visualisation school openness (A4) for each participant: Annex 1 Short PowerPoint presentation on the 8 dimensions: slide 4-27

	<u>Important to know!</u> Tell the participants that overlap is possible between the different dimensions.		
3	**Group discussion**: Our Science Education Openness From the individual visualisations to a joint visualisation of the science education openness • Are there clear differences/similarities between your individual answers? • How do we understand the variables? *F.e. Why did I put my science education there on the continuum for shared governance? And why did you put it more to the inward/outward mode?* • *Would the positioning be the same if you considered the openness of the whole school?* *<u>Important to know!</u>* • Each variable must receive attention during the group discussion. • There are different levels of importance in the focus group. We choose to start the conversation bottom-up. 1) Start at discussion from the level how the respondents perceive their science education level; 2) Ask for (possible) differences if they would consider on the whole school instead of their science education. • At the end of the group discussion all the participants – together with the focus group leader – come to a joint visual representation of the science education openness (color 1) and the school openness (color 2).	40'	Visualisation school openness (A3) for leader of the focus group: Annex 1 Audio recording material
4	**Group discussion:** link to the guidance (WP3-4-5) during the participation in the COSMOS project • When you see the visual representation of your science education openness, what would you like to see different? • And why?	20'	Visualisation school openness of the school at the end of the focus group of the initiation stage Audio recording material

Annex 3 – Guideline focus group at the end of the implementation round

- Can be integrated in a TPD activity
- Questions marked in green could also be taken in individual interviews. Do what makes sense in your context. We then expect you to analyse these interviews in the same way as for the focus groups, as suggested in this manual.

Part	Content	Timing	Material

1	**Group discussion*: reflecting on the COSMOS project**
	• Could you provide me with a brief recap of your COSMOS activities from this year?
	• What are you most proud of? Why?
	• Have you constructed your lessons/project according to the steps of SSIBL pedagogy? How? (*show visualisation of SSIBL-CoP: PowerPoint*)
	    • What helped you while doing SSIBL?
	    • What was difficult about SSIBL?
	    • What got in the way of doing SSIBL?
	• Have you involved (members of) communities around the school in the project at your school?
	    • Who was involved? How did they contribute?
	    • What helped you in involving the community?
	    • What was difficult about involving the community?
	    • Did the involvement of the community contribute to a stronger connection with the community? How?
	• Did the designing and implementing the project at your school affect how you think about what science education can be?
	    • Can you connect that to the SSIBL pedagogy?
	    • And to involving the community?
	• To what extent did the professional development activities of the COSMOS project help you in your development as a teacher?
	• Did the COSMOS project change anything about the way you teach your science classes? And if so, what and how?
	• Do you believe that what you gained from doing COSMOS will be sustainable in your science education?
	    • How?
	    • Will you do this together with colleagues? How? (organizational culture)
	    • What would you need to do an implementation like this again?
		30'	Audio recording material
			PowerPoint slide – visualization of SSIBL-CoP

	• What would be needed to anchor this approach to science education at your school? (*organizational, practical, professional development …*)		
2	**Link to school openness dimensions** At the beginning of the project we talked about the 8 school openness dimensions. (Show the visualization of the openness wheel.) • Do you see connections between what you did within the project and the school openness dimensions? (Show the visualization of the openness wheel of the school at the initiation stage – new schools OR at the end of the first implementation round – continuing schools.) • Looking at the wheel and reflecting on where we left off and where we are now, what changed? • At the end of the previous focus group, you decided to work on … (*the dimensions they chose to work on within the COSMOS project*). Do you think that going through the project, anything has changed in this regard? *Barriers – facilitators for the identified dimensions** ○ If so, what helped you evolve more outwardly? ○ What was difficult evolve more outwardly? ○ What got in the way of evolving more outwardly? *Important to know!* At the end of the focus group discussion all the participants – together with the focus group leader – come to a joint visual representation of the science education openness after their participation in the implementation round. * If they indicated earlier in the conversation that they also see changes in other dimensions, this is certainly the time to probe further for barriers - facilitators here as well. If not, you don’t need to go through them all.	15’	Visualisation school openness of the school at the end of the focus group of the initiation stage Visualisation school openness (A3) for leader of the focus group: Annex 1 Audio recording material

Annex 4 – Template for sharing results of the CORPOS-CoP focus groups – PRE (country level)

!! This template intended for you to use as a summary of results across all individual schools in your country. You can use the separate individual school template first to capture the results of each school, and then summarize those into this template. Please share this country level summary with WP7 by the agreed upon deadline.

Template filled in by :
Country :
Included schools are :
** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P) & Technical Gymnasium Rijnerveen (S)*

1. Understanding facilitators and barriers to the school openness attributes (across schools)

- *Describe all facilitators and barriers that you identify across the schools in your country.*
- *Be concise, describe them in about 50 words. Use a new bullet for each facilitator and/or barrier.*
- *Only fill in the cells that are mentioned in the focus groups. Leave the others blank.*
- *Main focus is on the openness of science education. Results at this level go into the first table.*
- *If you document anything about the openness of the school, document these into the second table.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

Openness of science education	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• …	• …

Openness of the school	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• … • …	• … • …

Annex 5 – Template for sharing results of the CORPOS-CoP focus groups – POST (country level)

!! This template intended for you to use as a summary of results across all individual schools in your country. You can use the separate individual school template first to capture the results of each school, and then summarize those into this template. Please share this country level summary with WP7 by the agreed upon deadline.

Template filled in by :

Country :

Included schools are :

** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P) & Technical Gymnasium Rijnerveen (S)*

1. Understanding facilitators and barriers to the school openness attributes (across schools)

- *Describe all facilitators and barriers that you identify across the schools in your country.*
- *Be concise, describe them in about 50 words. Use a new bullet for each facilitator and/or barrier.*
- *Only fill in the cells that are mentioned in the focus groups. Leave the others blank.*
- *Main focus is on the openness of science education. Results at this level go into the first table.*
- *If you document anything about the openness of the school, document these into the second table.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

Openness of science education	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• …	• …

Openness of the school	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• … • …	• … • …

2. Openness : (how) did COSMOS contribute to moving from inward to outward?

- *Describe concisely how one or two rounds of COSMOS implementation contributed to changes in the school's openness attributes they worked on.*
- *Use both visualizations of the openness wheel from the pre and post FG (comparison). You don't need to add these here, just use them as input for answering the question.*
- *Mention which attributes the CORPOS were identified as a goal towards developing (pre) and if and how COSMOS contributed in achieving this ambition.*
- *Put focus on the changes as well as key processes that are mentioned as contributing to them.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words across all schools in your country

3. Teacher identity : How did COSMOS contribute to the process of teacher professional learning, and SSIBL-COP teacher identity development?

- *Describe concisely how one or two rounds of COSMOS implementation contributed to changes in teacher's science identity.*
- *Use the answers provided by teachers in the post focus group (or individual interview) to describe this for each school.*
- *Put focus on the changes as well as key processes that are mentioned as contributing to them.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words across all schools in your country

4. Which are the critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools?

- *Describe concisely which barriers and facilitators were presented across all schools in your country when implementing the SSIBL-CoP*
- *Pay attention to :*
  - *designing / preparing SSIBL-CoP implementations*
  - *involving communities around the school*
  - *the actual implementation with students*
  - *the SSIBL phases : Ask – Find Out – Act*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words across all schools in your country

5. Which are the critical factors that facilitate or impede viable and sustainable CORPOS in schools?

- *What do members of the focus groups identify as conditions / resources / … that they feel would be needed toward viable and sustainable implementation of the CORPOS in their schools?*
- *Remember that we have not actively supported school in embedding the CORPOS (but rather facilitated SSIBL-CoP implementations).*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words across all schools in your country

Annex 6 – Template for sharing results of the CORPOS-CoP focus groups – PRE (school level)

!! This template is meant for you to summarize the results of individual schools. You can complete one of these for each school. The completed templates are for you to keep. WP7 needs a country summary. A separate template is provided for that, which needs to be shared with WP7 by the agreed upon deadline.

Template filled in by :
Country :
School :
** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P)*

1. Understanding facilitators and barriers to the school openness attributes (across schools)

- *Describe all facilitators and barriers that you identify in this specific school.*
- *Be concise, describe them in about 50 words. Use a new bullet for each facilitator and/or barrier.*
- *Only fill in the cells that are mentioned in the focus groups. Leave the others blank.*
- *Main focus is on the openness of science education. Results at this level go into the first table.*
- *If you document anything about the openness of the school, document these into the second table.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

Openness of science education	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• …	• …
Community collaborations	• …	• …

Openness of the school	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• … • …	• … • …

Annex 7 – Template for sharing results of the CORPOS-CoP focus groups – POST (school level)

!! This template is meant for you to summarize the results of individual schools. You can complete one of these for each school. The completed templates are for you to keep. WP7 needs a country summary. A separate template is provided for that, which needs to be shared with WP7 by the agreed upon deadline.

Template filled in by :
Country :
School :
** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P)*

1. Understanding facilitators and barriers to the school openness attributes (across schools)

- *Describe all facilitators and barriers that you identify in this specific school.*
- *Be concise, describe them in about 50 words. Use a new bullet for each facilitator and/or barrier.*
- *Only fill in the cells that are mentioned in the focus groups. Leave the others blank.*
- *Main focus is on the openness of science education. Results at this level go into the first table.*
- *If you document anything about the openness of the school, document these into the second table.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

Openness of science education	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• …	• …
Community collaborations	• …	• …

Openness of the school	Facilitators	Barriers
Shared governance	• … • …	• … • …
Open curriculum	• … • …	• … • …
Inner school communities	• … • …	• … • …
Learning communities	• … • …	• … • …
Student participation	• … • …	• … • …
Parental involvement	• … • …	• … • …
Social engagement	• … • …	• … • …
Community collaborations	• … • …	• … • …

2. Openness : (how) did COSMOS contribute to moving from inward to outward?

- *Describe concisely how one or two rounds of COSMOS implementation contributed to changes in the school's openness attributes they worked on.*
- *Use both visualizations of the openness wheel from the pre and post FG (comparison). You don't need to add these here, just use them as input for answering the question.*
- *Mention which attributes the CORPOS were identified as a goal towards developing (pre) and if and how COSMOS contributed in achieving this ambition.*
- *Put focus on the changes as well as key processes that are mentioned as contributing to them.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words for this specific school

3. Teacher identity : How did COSMOS contribute to the process of teacher professional learning, and SSIBL-CoP teacher identity development?

- *Describe concisely how one or two rounds of COSMOS implementation contributed to changes in teacher's science identity.*
- *Use the answers provided by teachers in the post focus group (or individual interview) to describe this for this specific school.*
- *Put focus on the changes as well as key processes that are mentioned as contributing to them.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words for this specific school

4. Which are the critical factors that facilitate or impede SSIBL-CoP implementation in the COSMOS schools?

- *Describe concisely which barriers and facilitators were presented at this school when implementing the SSIBL-CoP*
- *Pay attention to :*
  - *designing / preparing SSIBL-CoP implementations*
  - *involving communities around the school*
  - *the actual implementation with students*
  - *the SSIBL phases : Ask – Find Out – Act*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words for this specific schools

5. Which are the critical factors that facilitate or impede viable and sustainable CORPOS in schools?

- *What do members of the focus group identify as conditions / resources / … that they feel would be needed toward viable and sustainable implementation of the CORPOS in their schools?*
- *Remember that we have not actively supported school in embedding the CORPOS (but rather facilitated SSIBL-CoP implementations).*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*

About 300 words for this specific school

COSMOS Student questionnaire

Partner manual version 28.04.2024

for use in the second implementation round

Corresponding authors : Mart Doms & Jelle Boeve-de Pauw (WP7)

mart.doms@kdg.be

Content

Disclaimer : *This manual is for use within the COSMOS consortium only. It is not to be circulated outside the consortium without a documented agreement of the COSMOS executive board. The manual serves to support the administration of the focus groups in the different partner countries during the first implementation round in academic year 2022-2023. It will be further developed based on experience toward the second implementation round in the academic year 2023-2024. All correspondence can be addressed to* mart.doms@kdg.be

1. Student questionnaire

Objective – Determining the interest in science, science career aspirations and active/responsible citizenship of the participating students

Why?

- Provide information on the pedagogical process
- Describe impact (at the end of the implementation rounds)

When?

- At the beginning of the implementations (round 1 – round 2) and at the end of the implementations
- Suggested timeframe :
  - **Pre-survey**: before the first session within the COSMOS project with the students
  - **Post-survey**: within two weeks after the last session within the COSMOS project with the students

Who?

- All the students participating in activities within the COSMOS project
- Taking the questionnaire is supervised by the teacher. If necessary, the HEI can be present if the school wishes.

Where?

- Ideally at the school during the lessons
- Other possibilities: homework, during break …

What?

Survey – pre implementation round 2

https://kdg.eu.qualtrics.com/jfe/form/SV_1FGNTY5zPYYTMfI

Survey – post implementation round 2

https://kdg.eu.qualtrics.com/jfe/form/SV_6A1LdSa3n5Ycfpc

Guidelines

- Be sure to seek parental consent in a timely manner, when required.
- There are no right or wrong answers. Students need to reflect and talk about their opinion and experiences at this moment.

2. Data Collection

2.1 Near the start of the implementation

Consent parents

You can find the Flemish example of the consent form for the parents (Annex 1), the information letter about the COSMOS project (Annex 2) and a short information letter (Annex 3) in the annexes. Please adapt it to the expectations of your educational or research context.

Start collecting consent forms well in time. If there are students who filled in the questionnaire, but whose consent we do not have, you should let us know at mart.doms@kdg.be.

The students themselves give their consent in the questionnaire.

Equipment

- A device for each student to complete the questionnaire on: tablet, computer, mobile phone ...
- Optional: a short letter to the teacher with the link to the questionnaire – pre (Annex 4)
- Optional: a short letter to the students with the link to the questionnaire – pre (Annex 6)

2.2 After the end of the implementation

Equipment

- A device for each student to complete the questionnaire on: tablet, computer, mobile phone ...
- Optional: a short letter to the teacher with the link to the questionnaire – post (Annex 5)
- Optional: a short letter to the students with the link to the questionnaire - post (Annex 7)

2.3 Deadline data collection – second implementation round

30th of June

(if not possible, please discuss with Mart & Jelle)

3. Data analysis

KdG will coordinate the cleaning and analysis of the data

Annex 1 – Consent form parents (example Flanders)

Creating Organizational Structures for Meaningful Science education through Open Schooling for all

Toestemmingsformulier voor deelname aan het onderzoek,

Bestemd voor ouders van minderjarige deelnemers

Hierbij bevestig ik, ondergetekende (NAAM & VOORNAAM in blokletters),

____, ouder of wettelijke vertegenwoordiger

Van leerling (NAAM & VOORNAAM in blokletters)

____

Van deze school ____ en deze klas ____________________________

dat ik over het onderzoek ben ingelicht en een kopie van de "Informatie voor deelnemers" en het "Toestemmingsformulier"(Bijlage 1) heb ontvangen. Ik heb de informatie gelezen en begrepen. De uitvoerder van het onderzoek heeft mij voldoende informatie gegeven met betrekking tot de voorwaarden en de duur van het onderzoek, én het effect hiervan. Bovendien werd mij voldoende tijd gegeven om de informatie te overwegen en om vragen te stellen, waarop ik bevredigende antwoorden gekregen heb.

- Ik heb begrepen dat ik de deelname van mijn kind aan het onderzoek op elk ogenblik mag stopzetten nadat ik de uitvoerende onderzoeker hierover heb ingelicht, zonder dat dit mij enig nadeel kan berokkenen.
- Ik geef toestemming aan de verantwoordelijken van de opdrachtgever(s) en aan regulerende overheden om inzage te hebben in mijn dossier. De door mijn kind aangeleverde gegevens zullen strikt vertrouwelijk worden behandeld. Ik ben mij bewust van het doel waarvoor deze gegevens verzameld, verwerkt en gebruikt worden in het kader van het onderzoek.
- Ik ga akkoord met de verzameling, de verwerking en het gebruik van deze gegevens, zoals beschreven in het informatieblad voor de participant (**vink aan** welke gegevens we mogen verzamelen bij uw kind)
  - ☐ Vragenlijstonderzoek bij de start en het eind van het project
  - ☐ Groepsgesprek aan het einde van het project
- Ik ga akkoord met het gebruik door de opdrachtgever van deze gecodeerde gegevens voor andere onderzoeksdoeleinden.
- Ik stem geheel vrijwillig toe tot deelname van mijn kind aan het onderzoek.

Datum: ______________________

Handtekening ouder of wettelijk vertegenwoordig(st)er:

____

Annex 2 – Information sheet parents (example Flandres)

Informatiebrief over deelname aan het COSMOS project aan de ouder/voogd van deelnemende leerlingen.

De school van jouw kind heeft besloten om deel te nemen aan het COSMOS onderzoeksproject. In deze brief vind je informatie over het project en wat het voor jouw kind betekent om er aan deel te nemen. Je mag ook steeds een vraag aan ons richten via de contactgegevens onderaan deze brief.

1. Doel van het project

Het doel van het project is om te onderzoeken hoe scholen les kunnen geven over wetenschappelijke kwesties waarvoor geen eenvoudig of eenduidig antwoord voor is: de zogenaamde duurzaamheids- of socio-wetenschappelijke kwesties. Dit kan gaan over genetica, over het milieu, communicatietechnologie, vaccinatie, enzovoort. Het idee van het COSMOS project is dat scholen (leerkrachten en leerlingen) hier samen aan kunnen werken met organisaties buiten de school, zoals musea, bedrijven, wetenschappers, enz. COSMOS is een samenwerking met onderzoekers uit verschillende landen (Nederland, België, Portugal, het Verenigd Koninkrijk, Zweden en Israël). In België is de Karel de Grote Hogeschool (KdG) verantwoordelijk voor het goede verloop van het project. We krijgen voor dit project financiering van de European Research Council. Het project kent een looptijd van 3 jaar: we startten in januari 2022 en ronden af in december 2024.

2. Beschrijving van de deelname aan het project

In het kader van het project zal jouw kind tijdens de schooluren deelnemen aan diverse activiteiten tijdens de lessen over wetenschap. Soms zullen die lessen op school zijn en soms kan het betekenen dat je kind met de klas naar een museum of bedrijf gaat, of dat er iemand van een organisatie naar de school komt. Dit zal een deel zijn van het gewone lesprogramma, jouw kind neemt hier net als de andere kinderen in de klas sowieso aan deel. We willen je ook informeren dat we daarnaast ook informatie zullen verzamelen die ons moet helpen om het project te evalueren. Informatie over jouw kind verzamelen we enkel met uw toestemming en indien je kind kiest om hier vrijwillig aan deel te nemen.

Als je toestemming geeft en je kind stemt in, dan krijgt het in de komende maanden twee keer een korte vragenlijst met een aantal vragen om te beantwoorden. Dat kan steeds doen zonder een naam te geven: zo blijven de antwoorden anoniem en weten de onderzoekers en de leerkracht niet welke leerling welke antwoorden gaf. De vragenlijst gaat vooral over jouw kind's mening over de inhoud en aanpak van de wetenschapslessen op de school. Er zijn daarbij dan ook geen juiste of foute antwoorden: het is de mening van de kinderen waarin we interese hebben. De antwoorden hebben ook geen invloed op schoolresultaten en we delen ze ook niet met leerkracht(en), klasgenoten of ouders.

In de loop van het schooljaar zullen we één of enkele groepsinterviews houden met een aantal leerlingen (ongeveer 30-40 minuten/interview). Dat doen we enkel met leerlingen die dat zelf willen. We komen tijdens het schooljaar ook een keer in de klas kijken wat er zoal gebeurt tijdens de les, we zijn dan vooral geïnteresseerd in hoe de leerkracht de les aanpakt. Tijdens deze observaties zal een onderzoeker aanwezig zijn en aantekeningen maken van wat zij/hij ziet gebeuren. Zowel je kind als jij als ouder, mogen na de les deze onderzoeker contacteren met vragen over de inhoud van de observaties. Alle neerslag hierbij is volledig anoniem: de naam van uw kind wordt nooit genoteerd en de notities worden niet met je klasgenoten, de leerkracht of ouders gedeeld.

Nadat alle gegevens van de vragenlijsten, het groepsinterview en de observaties zijn verzameld, zullen wij deze verwerken en vervolgens plannen om de resultaten in een wetenschappelijk artikel te schrijven. Daarbij zal geen informatie worden gegeven over wie heeft deelgenomen: de naam van uw kind en die van de leerkacht(en) en school worden nooit vermeld.

3. Verwerking van persoonsgegevens.

Alle gegevens die wij verzamelen, zullen we zo verwerken dat er nooit iemand inzage in krijgt die niet tot het onderzoeksteam behoort. De gegevens worden tot 10 jaar na het einde van het project bewaard en vervolgens gewist, overeenkomstig het plan van de KdG Hogeschool voor het bewaren en wissen van onderzoeksmateriaal. Je hebt steeds het recht (zonder dat dat je iets kost) toegang te vragen tot alle gegevens die we over jouw kind verzamelden en verwerkten. Je hebt ook recht op correctie van eventuele fouten en om te vragen dat de gegevens die we over jouw kind verzamelden worden gewist, of slechts gedeeltelijk of helemaal niet worden verwerkt. Met zo'n verzoek kan je terecht bij privacy@kdg.be.

Deelname aan het onderzoek is vrijwillig en kan op elk moment stop gezet worden zonder dat daartoe een motivering nodig is.

4. Contactgegevens

Mart Doms
Onderzoekmedewerker COSMOS
Onderzoekscentrum Toekomstgedreven Onderwijs
KdG Hogeschool
mart.doms@kdg.be

Annex 3 – Short information letter parents (example Flanders)

Antwerpen, 1 september 2023

Beste ouder/voogd

De school van uw kind zal deelnemen aan het **COSMOS onderzoeksproject**. In dit project onderzoeken we hoe scholen les kunnen geven over wetenschappelijke kwesties waarvoor geen eenvoudig of eenduidig antwoord is: de zogenaamde duurzaamheids- of socio-wetenschappelijke kwesties.

In het kader van dit project zal uw kind tijdens de schooluren twee keer een korte **vragenlijst** invullen. Ook zullen enkele leerlingen deelnemen aan één of meerdere **groepsinterviews**. Bij de verwerking van de verzamelde gegevens zal de naam van uw kind en die van de school/leerkracht nooit worden vermeld.

De activiteiten die in het kader van het project worden uitgevoerd, behoren tot het (verplichte) schoolprogramma. Voor de deelname aan de vragenlijst en het groepsinterview hebben wij uw **toestemming** nodig. Kan u hiertoe bijgevoegd **formulier** invullen, en zo spoedig mogelijk terug aan de school bezorgen?

Wenst u graag meer te weten te komen over het COSMOS onderzoeksproject en de deelname van de school aan dit project? Bezoek dan zeker de nieuwspagina van onze **website**.

https://www.cosmosproject.eu/be/news/

We hopen dat we u hiermee voldoende informeerden. Indien u nog vragen heeft, kan u steeds bij ons terecht via mart.doms@kdg.be.

Met vriendelijke groeten

Het COSMOS team van de Karel de Grote Hogeschool

Philippe Bastiaenssens

Jelle Boeve-de Pauw

Mart Doms

Bijlage 1: Toestemmingsformulier deelname COSMOS

Annex 4 – Link to student questionnaire (for teachers) - PRE

Dear teacher

Thank you in advance for taking part in our questionnaire with your students.

You can participate via the link below (url or QR):

https://kdg.eu.qualtrics.com/jfe/form/SV_1FGNTY5zPYYTMfl

Pre implementation

Kind regards

The COSMOS team

Annex 5 – Link to student questionnaire (for teachers) – POST

Dear teacher

Thank you in advance for taking part in our questionnaire with your students.

You can participate via the link below (url or QR):

https://kdg.eu.qualtrics.com/jfe/form/SV_6A1LdSa3n5Ycfpc

Post implementation

Kind regards

The COSMOS team

Annex 6 – Link to student questionnaire - PRE

Dear pupil

Thank you in advance for taking part in our questionnaire with your students.

You can participate via the link below (url or QR):

https://kdg.eu.qualtrics.com/jfe/form/SV_1FGNTY5zPYYTMfl

Pre implementation

Kind regards

The COSMOS team

Annex 7 – Link to student questionnaire - POST

Dear pupil

Thank you in advance for taking part in our questionnaire with your students.

You can participate via the link below (url or QR):

https://kdg.eu.qualtrics.com/jfe/form/SV_6A1LdSa3n5Ycfpc

Post implementation

Kind regards

The COSMOS team

Appendix 3 - Student Survey

Horizon2020
European Union Funding
for Research & Innovation

COSMOS

English (United Kingdom)

Introduction

Choose your language at the top right of this page
Kies je taal rechts bovenaan deze pagina.
Escolha a sua língua na parte superior direita deste página.
Välj språk högst upp till höger på denna sida.
בחרו שפה בראש העמוד בצד ימין
اختر لغة في أعلى الصفحةِ على اليمينِ

>>>

Dear pupil

We are researchers from the University of Southampton and Winchester Science Centre and we are working with teachers at your school for the COSMOS project. We will help you learn about how science connects to everyday life through topics like the environment and climate change. We will do this by inviting people from the university, from local industries and businesses to come and talk to you about how their work relates to your science lessons.

Your teacher is participating in the COSMOS project.

For this project, you will be asked to complete a survey twice: today for the first time and then again in June. In this survey we ask you about your views on science and science education.

There are no right or wrong answers, we are interested in your honest opinion and your experiences.

We will not share your answers with your teachers or with anyone else at your school, nor with your parents. All data will remain confidential and will be managed and destroyed in accordance with University of Southampton policy.

We have also shared information about the project with your teacher and with your parents/guardians, who agree for you to take part. If you have any concerns about your participation, you can talk to your science teacher or contact us directly at: a.christodoulou@soton.ac.uk.

Thanks for participating!

The COSMOS team: Andri Christodoulou, Marcus Grace, Samantha Weston, Andy Keenan, Rachel Baker

ERGO number: 70571

By continuing you agree that your results will be used in the COSMOS project.

Do you want to continue?

- Yes
- No. If so, the survey will terminate.

Are you sure you want to leave this survey?

- Yes

○ No

Can you can confirm to us you really are a human?

☐ I'm not a robot
reCAPTCHA
Privacy - Terms

Background Questions (Anonymous alternative)

We want to be able to connect your answers from this survey to those of the next one.
To do that, while respecting your anonymity, we need some information from you.
This will help us to match your answers from both surveys.

What are the first two letters of your surname?

What are the first two letters of your mother's first name? (or of the person you consider your mother)

In which month were you born?

Do you speak the same language at home as the language of instruction at school?

- Yes
- No

What is your gender?

- Female
- Male
- Non-binary / third gender
- Prefer not to say

What is your gender?

- ◯ Female
- ◯ Male
- ◯ Prefer not to say

How old are you?

	8	9	11	12	13	15	16	17	18	20	21	
I am ... years old												

What is the name of your school?

Which of these is your school?

- ◯ CLW Antwerpen - campus Merksem
- ◯ CLW Antwerpen - campus Borgerhout
- ◯ Novaplus

Which of these is your school?

- ◯ Anna Van Rijn College
- ◯ Christelijk Lyceum Veenendaal (CLV)

Which of these is your school?

- ◯ Agrupamento de Escolas Alfredo da Silva, Sintra
- ◯ Agrupamento de Escolas Romeu Correia, Almada

Which of these is your school?

- ◯ ברטוב
- ◯ גימנסיה עברית
- ◯ אלזהרא
- ◯ לפיד המ"ה

What Year group are you in?

Students' Interest in Science and Science Carreer Aspirations

In this section we will ask your **opinion about science and science education**.

We will present you with six sets of statements and invite you to indicate how much you agree with these.

Remember, there are no right or wrong answers. We are interested in your opinion.

First, let's think about a job or career you would like after you have finished your education.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
I will probably choose a job in a field of science	○	○	○	○	○
I would enjoy a job in a field of science	○	○	○	○	○
I would like a career in science later on	○	○	○	○	○
Working in science would be interesting	○	○	○	○	○

If you want, you can explain (some of) your answers.

Now think of your science lessons at school.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
Science education is important	○	○	○	○	○
I would rather not have science education at school	○	○	○	○	○
If there was an after school science club, I would join it	○	○	○	○	○
At school, I am not interested in science	○	○	○	○	○
There should be more science education at my school	○	○	○	○	○

If you want, you can explain (some of) your answers.

Some students may feel that science is not that interesting.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
I do not understand why anyone would want a job in science	○	○	○	○	○
Most jobs in science are boring	○	○	○	○	○
I think science is boring	○	○	○	○	○

If you want, you can explain (some of) your answers.

Some people feel that science might be something that is more for boys than for girls.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
Boys are better at science than girls	○	○	○	○	○
Boys know more about science than girls	○	○	○	○	○
Boys are more capable than girls of doing a job in science	○	○	○	○	○

If you want, you can explain (some of) your answers.

Below are some statement about the relevance of science.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
Science can help improve our lives	○	○	○	○	○

	Not at all	A little	A moderate amount	A lot	Completely agree
Science is important in society	○	○	○	○	○
Everybody needs science	○	○	○	○	○
Science is usefull in my daily life	○	○	○	○	○

If you want, you can explain (some of) your answers.

A short check-in to see if you are still awake. How much is 3 + 4 ?

- ○ 5
- ○ 7
- ○ 9
- ○ 11
- ○ 13

Now we'd like to know your opionion about how difficult you feel science is.
How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
You have to be smart to study science	◯	◯	◯	◯	◯
Science is only for smart people	◯	◯	◯	◯	◯
To study science, you need to be talented	◯	◯	◯	◯	◯
You can only be good at science if you are also good at maths	◯	◯	◯	◯	◯

If you want, you can explain (some of) your answers.

Active/responsible Citizenship

We are almost at the end of the survey.

In this final section we will ask for your opinion about if you feel you can **contribute as a citizen to a sustainable future**.
We will present you with three sets of statements and invite you to indicate how much you agree with these.

How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
I can see different points of view on issues when people think differently	○	○	○	○	○
I know how one should take action at school in order to contribute to sustainable development.	○	○	○	○	○
I know how one should take action at home in order to contribute to a sustainable future.	○	○	○	○	○
I know how one should take action together with others in order to contribute to a sustainable societal future.	○	○	○	○	○

If you want, you can explain (some of) your answers.

How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
I believe I can influence global sustainable future through my actions.	○	○	○	○	○
I believe I can influence sustainable future in my community.	○	○	○	○	○
I believe I have good opportunities to participate in influencing our shared future.	○	○	○	○	○
I believe what each person does matters for sustainable future.	○	○	○	○	○

If you want, you can explain (some of) your answers.

How much do you agree with these statements?

	Not at all	A little	A moderate amount	A lot	Completely agree
I want to take action for sustainable future in my community.	○	○	○	○	○
I want to take action for global sustainable future.	○	○	○	○	○
I want to engage in changing society towards sustainable future.	○	○	○	○	○
I want schoolwork to be about how we can shape a sustainable future together	○	○	○	○	○

If you want, you can explain (some of) your answers.

End of Survey

Thank you for your answers. These really help us in our research!
The COSMOS team

Powered by Qualtrics

COSMOS

Student group interviews

post implementation

Partner manual version 12.06.2024

For use in the second implementation round

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Content

1. Context

1.1 Objective

To broaden our understanding of participating students' attitudes towards science, active citizenship, experiences with open schooling in the context of science education at their school. The group interviews deal with similar aspects of learning and implementation as the student surveys, but allow for richer and deeper understanding of the student perspective.

1.2 Interview administration

There are several versions of the group interview, depending on the target:

- Post-implementation version for use in primary schools;
- Post-implementation version for use in secondary schools.

Who should participate in these interviews?

- ➢ The interviews are to be administered with groups of three students for each implementation. An implementation is to be understood as a project within a school. If multiple groups in the same school implements the same project, then only one group of students needs to be interviewed. If multiple projects (i.e. different project in different groups within the same school) are implemented, the as many interviews need to be administered as there as projects : one group for each project.

When should the group interviews take place?

- ➢ The timing follows the same timeline as the administration of the student post survey.
- ➢ Within two weeks after completing the implementation. Completion is understood as the school team's interpretation of having finalized the entire SSIBL-COP implementation.

Where should the group interview take place?

- ➢ You are free to organize this in a way that makes most sense in your local context. This can be at or outside the school or online, during or after class hours.

1.3 Guidelines

- Be sure to seek parental consent in a timely manner, as required by your local regulations.
- There are no right or wrong answers. Students need to reflect and talk about their opinion and experiences at this moment.
- It might be practical to organize the administration of the student post survey and the student group interview in one go. This keep the logistics and need for communication with the school low.
- This is a semi-structured interview. The questions are suggested to guide your conversation, so feel free to adapt the conversation as it goes. But make sure that you are meeting the objectives of the different parts (cursive, in the beginning of each part). Mandatory questions are indicated **in green and in bold**.

2. Post-implementation version for use in primary schools

2.1 Practical information

- Version years 5 & 6 primary school (10-12 year-olds)
- Group discussion with 3 students
- Materials : association cards for kids (eg. these or these)
  (optional: papers, colored pencils, colored markers)
- Audio recording is needed : bring equipment for audio recording
- Max 45 minutes

2.2 Interview scheme

0. Intro (5 minutes).

Getting to know the pupils and reassure them.
Inform pupils about what they are participating in and what is expected of them.

- Welcome all. Shall we introduce ourselves?
- I am *NAME* and I am a researcher. Some researchers go in search of new animal species, others develop new batteries or find ways to pollute nature less. I am another kind of researcher. I am interested in school children, what they like to learn and how they like to do that. I research children's opinions and experiences. And that's why I'm here today.
- I'm interested in who you are. Would you mind telling me? What are your names and your hobbies? Who likes to go first?
- Nice. Now we already know each other a little bit.
- During this session we will talk about science and how you experienced the project '…'[1] at your school. I am curious to know how the project went at your school and what you think of that. Our conversation will last about 40 minutes. I am going to record it so that I can listen to it again later. I am not sharing any of this conversation with your teachers or parents. I would especially like you to share your experiences and opinions. There are no right or wrong answers, I just want to know what you think.

1. The COSMOS project at the school (10 minutes)

A brief reflection with the pupils on the project: What did they do in the project? What would they do differently? What did they learn?

Objective: Prepare the students for the following parts of the student group interview

- Let's talk about the project[2].
  Where was your project about? What did you do? How long did it take? Were you somewhere out of the school? If so, where?
- What did you learn within the project? Where did you talk about?
- What did you like most about the project? Why?
- What did you find most difficult about the project? Why?
- What would you like to change about the project?

2. Attitudes towards science (10 minutes)

Have students to talk about the link between what they learn in school and what happens in their daily lives (outside the school) and about the contribution of the project towards their perception of relevance of science and science career aspirations.

- Sometimes in science lessons we learn about what happens outside the classroom or school in our everyday life.[3]
  Do you know (any other) examples like that?

- **Did you learn, within the project, something about what happens outside the classroom? Or about what happens when you're not at school?**

- Do you learn often at your school about what happens outside the school? What do you think about that?

- Do you think what we learn in science makes a difference to what we do outside of school?

- **In the project, did you learn anything about scientists and what exactly they do in their jobs? Would you like to do that yourself one day?**

3. Daydream / active citizenship (10 minutes)

Probing the extent to which the project produced a change in action competence: both for their knowledge of action possibilities, their confidence in their own influence as for their willingness to act

- In this last section, we are going to dream together. Think about how you'd envision an improvement in … [4]

- Choose a card that matches the representation of your dream.

- Which card did you choose and why?

- In the project, we learnt about … [4] We know that this is a world problem with a lot of complex, possible, partial solutions. **But what do you believe, you – as a child – can change about …[4]? What did you learn in the project about how you can change something about … [4]?**

- **Do you believe you can change something about … [4]? What? Did the project help you in this belief? Give an example.**

- **Are you willing to change something else about … [4]? Which changes would you like to make? Did the project help you in this willingness to change something? Give an example.**

- **What else could or would you do to … [4], even if it is only a small step towards it? Would you do something else since you were guided through the project? Give an example.**

4. Thank you, we are ready!

- You guys helped me a lot. What did you guys think of this conversation? Is there anything else you would like to say about science, science learning or the project?

[1] *Mention the name or the theme/SSI of the project.*

[2] *If you have a group of students having a hard time talking about this, you can let them draw about the project. In this case, the drawing is a conversation-starter.*

[3] *If the students aren't telling a lot or able to give an example themselves, please guide them to an example of the project or something else that should be meaningful to them.*

[4] *Hereby specifically mention something around the SSI that has been discussed and worked on within the project*

e.g. if the pupils worked on the theme 'water waste and water pollution', let them dream about: what else could or would you do to combat water waste and pollution?

3. Post-implementation version for use in secondary schools

3.1 Practical information

- Version year 1-6 secondary school (13-18+ year-olds)
- Group discussion with 3 students
- Materials : association cards for kids (eg. these or these)
- Audio recording is needed : bring equipment for audio recording
- Max 45 minutes

3.2 Interview scheme

0. Intro (5 minutes).

Getting to know the pupils and reassure them.
Inform pupils about what they are participating in and what is expected of them.

- Welcome all. Shall we introduce ourselves?
- I am *NAME* and I am a researcher at *XXX*. In my research, I am interested in the teaching and learning of science at school. And that's why I'm here today.
- I'm also interested in who you are. Would you mind telling me?
- Please tell your names and something interesting about yourself? Who'd like to go first?
- Nice. Now we already know each other a little bit.
- During this session we will talk about science and how you experienced the project '…'[1] at your school. I am curious to know how they the project went at your school and what you think about it.
- Our conversation will last about 40 minutes. I am going to record it so that I can listen to it again later. I am not sharing any of this conversation with your teachers or parents. I would especially like you to share your experiences and opinions with us. There are no right or wrong answers, I just want to know what you think.

1. The COSMOS project at the school (about 10 minutes)

A brief reflection with the pupils on the project: What did they do in the project? What would they do differently? What did they learn?

Objective: Prepare the students for the following parts of the student group interview

a. Let's talk about the project[2].
   Where was your project about? What did you do? How long did it take? Were you somewhere out of the school? If so, where?
b. What did you learn within the project? Where did you talk about?
c. What did you like most about the project? Why?
d. What did you find most difficult about the project? Why?
e. What would you like to change about the project?

2. Attitudes towards science (about 10 minutes)

Probing the extent to which the project produced a change in action competence: both for their knowledge of action possibilities, their confidence in their own influence as for their willingness to act

- Sometimes science lessons deal with something that takes place outside of the school, in your everyday life, right?[2]
  Do you know of (any other) examples like that?

- **Did you learn, within the project, something about what happens outside the classroom? Or about what happens when you're not at school?**

- Do you learn often at your school about what happens outside the school? What do you think about that?

- Do you think what we learn in science makes a difference to what we do outside of school?

- **In the project, did you learn anything about scientists and what exactly they do in their jobs? Would you like to do that yourself one day?**

3. **Daydream / active citizenship (about 10 minutes)**

Probing the extent to which the project produced a change in action competence: both for their knowledge of action possibilities, their confidence in their own influence as for their willingness to act

- In this last section, we are going to dream together. Think about how you'd envision an improvement in … [3]

- Choose a card that matches the representation of your dream.

- Which card did you choose and why?

- In the project, we learnt about … [3] We know that this is a world problem with a lot of complex, possible, partial solutions. **But what do you believe, you – as a child – can change about …[3]? What did you learn in the project about how you can change something about … [3]?**

- **Do you believe you can change something about … [3]? What? Did the project help you in this belief? Give an example.**

- **Are you willing to change something else about … [3]? Which changes would you like to make? Did the project help you in this willingness to change something? Give an example.**

- **What else could or would you do to … [3], even if it is only a small step towards it? Would you do something else since you were guided through the project? Give an example.**

4. Thank you we are ready!

- You guys helped me a lot. What did you guys think of this conversation?

- Is there anything else you would like to say about science, science learning or the project?

[1] *Mention the name or the theme/SSI of the project.*

[2] *If the students aren't telling a lot or able to give an example themselves, please guide them to an example of the project or something else that should be meaningful to them.*

[3] *Hereby specifically mention something around the SSI that has been discussed and worked on within the project*

e.g. if the pupils worked on the theme 'water waste and water pollution', let them dream about: what else could or would you do to combat water waste and pollution?

4. Data analysis

Data

- Transcription of the audio recording of the student group interview

Data analysis

"Ideal picture"	Research (WP7)
Pre interview (Only Round 1)	***Triangulation*** • *Tracking PATS and SPACS, as validation of focus in questionnaire* • *Underpin starting position in schools with qual/quan : PATS and SPACS students*
Post interview (Round 1 & Round 2)	***Triangulation*** • *Tracking PATS and SPACS, as validation of focus in questionnaire* **Mapping change** • Contribution analysis from students' perspective • What changes in PATS and SPACS can be implicitly and explicitly derived from the interviews? • Which changes do students attribute to COSMOS? How and why? What exactly in the project (SSIBL) did this? • What other effects are there of COSMOS? <u>Results to be delivered at KdG</u> **Student-perceived outcomes** (narrative) – effect of COSMOS implementation from students' perspective: which changes and by what from the project? - PATS/SPACS - Other

How?

- To answer these questions we need to code the transcripts of the student group interviews.
- Coding will be at group level, i.e. we are not coding on individual participant level in the transcript.
- It might help to use the statements of the questionnaire while coding. The concretization of the different concepts of SPACS & PATS might support the coding process.

What do we provide for the research partners in the COSMOS consortium?

- <u>Codebook</u> with brief descriptions (Word & .qdc)
    - Deductive coding with provided codes
    - Inductive coding : room for additional 'local' codes
- A template for your national report of the student group interview: Annex 1
- A template for the report of the student group interview at individual school level: Annex 2

What do teams send back to us?

Results of coding process (narrative) so we can integrate into

- A report
- A publication?

Deadline

Monday the 9th of September 2024

Codebook

PATS – Pupils' Attitude Towards Science			
Science Career Aspirations	*SCA*		*The extent to which students hope to achieve a scientific career in their future professional life*
Students' Interest in Science	SIS		The extent to which the learner is attracted to science in which he or she can connect easily and without any difficulty or obstacle
Tediousness towards Science	TS		The extent to which a student finds science boring/annoying
Gendered View of Science	*GVS*		*The extent to which a student thinks sciences are more something for one gender (male) than the other gender (female)*
Relevance of Science	RS		The extent to which a student believes scientific knowledge allows us to develop new technologies, solve practical problems, and make informed decisions
Difficulty of Science	DS		The extent to which students think science is difficult
SPACS - Self-perceived action competence for sustainability			
Knowledge of Action Possibilities	KAP		The extent to which students believe they are having the knowledge of action possibilities and are able to deal with interrelated, complex and controversial problems
Confidence in own Influences	CI		The extent to which students feel aspects of self-effective and confident in their own influence
Willingness to Act	WA		The extent to which students feel
Change			
Other	O		Changes other than part of SPACS or PATS (see above)
Change	C		Change in a certain competent
Attributed to COSMOS	A		The situation where change is explicitly assigned to the COSMOS project

Reference codes for quotes

When including quotes, use a reference codes – 3 digits:

Country	P (Portugal) I (Israel) S (Sweden) N (the Netherlands) U (the United Kingdom) B (Belgium)
Round of implementation	1 (first implementation round) 2 (second implementation round)
School	A B C D (Provide each participating school from a code)

Data sharing

- See Data Management Plan:
  - Qualitative data are not shared among partners
  - Only results are shared.

Annex 1 - Template for sharing results of student group interviews (country level)

!! This template intended for you to use as a summary of results across all individual schools in your country. You can use the separate individual school template first to capture the results of each school, and then summarize those into this template. Please share this country level summary with WP7 by the agreed upon deadline.

Template filled in by :
Country :
Included schools are :
** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P) & Technical Gymnasium Rijnerveen (S)*

Effects of COSMOS implementation from student's perspective: Which changes are observed?

- *Concisely describe any impact the SSIBL-CoP implementation has had on students' attitudes towards science and active citizenship. Use the open questions from the group interview.*
- *Paste one or two relevant quotes in the cells of the learning outcomes that are brought up in the interview. Only fill in the cells that are addressed in the interview.*
- *You can categorize learning outcomes under PATS or SPACS, or both if that makes sense in your case.*
- *If you detect any other learning outcomes that the students mention in their interviews and that you feel are important to highlight, you can categorize them under 'other learning outcomes'.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*
- *If known, include the age of the student you are quoting. If the age is unknown, mention P for primary or S for secondary.*
- *Finally, include a brief summary (not more than 250 words) of those results that you feel are key outcomes of COSMOS in your country.*

PATS – Pupils' Attitude Towards Science	
Science Career Aspirations	
Students' Interest in Science	
Tediousness towards Science (Science is boring)	
Gendered View of Science	
Relevance of Science	
Difficulty of Science	

SPACS - Self-perceived action competence for sustainability	
Knowledge of Action Possibilities	
Confidence in own Influences	
Willingness to Act	
Other learning outcomes	
…	
…	
…	
Key outcomes at country level	
250 words max	

Annex 2 - Template for sharing results of student group interviews (school level)

!! This template is meant for you to summarize the results of individual schools. You can complete one of these for each school. The completed templates are for you to keep. WP7 needs a country summary. A separate template is provided for that, which needs to be shared with WP7 by the agreed upon deadline.

Template filled in by :
Country :
School :
** mark primary schools with a 'P' and secondary schools with an 'S' : e.g. VBS de Regenboog (P)*

Effects of COSMOS implementation from student's perspective: Which changes are observed in this school?

- *Concisely describe any impact the SSIBL-CoP implementation has had on students' attitudes towards science and active citizenship. Use the open questions from the group interview.*
- *Paste one or two relevant quotes in the cells of the learning outcomes that are brought up in the interview. Only fill in the cells that are addressed in the interviews*
- *You can categorize learning outcomes under PATS or SPACS, or both if that makes sense in your case.*
- *If you detect any other learning outcomes that the students mention in their interviews and that you feel are important to highlight, you can categorize them under 'other learning outcomes'.*
- *When including quotes, use the reference codes for interviews as mentioned in the manual.*
- *If known, include the age of the student you are quoting. If the age is unknown, mention P for primary or S for secondary.*
- *Finally, include a brief summary (not more than 250 words) of those results that you feel are key outcomes of COSMOS in this specific school.*

PATS – Pupils' Attitude Towards Science	
Science Career Aspirations	
Students' Interest in Science	
Tediousness towards Science (Science is boring)	
Gendered View of Science	
Relevance of Science	
Difficulty of Science	

SPACS - Self-perceived action competence for sustainability	
Knowledge of Action Possibilities	
Confidence in own Influences	
Willingness to Act	
Other learning outcomes	
…	
…	
…	
Key outcomes in this school	
250 words max	

Appendix 4 - Focus group Scheme - Societal partners

<u>Aims of the focus group with the societal partners</u>

- Exchange of experiences;
- Data collection on stakeholder outcomes & pedagogical processes
  - The societal partner as a stakeholder

<u>Core questions</u>

- What was your role as a societal partner in the project?
- What lessons do you take away from COSMOS concerning science education?
- What lessons do you take away from COSMOS on the level of your organisation?

<table>
<tr><td>1</td><td>Check-in
What has been the biggest setback or success for you in the past two and a half years of COSMOS?</td><td>Recording material</td></tr>
<tr><td>2</td><td>Loved – learned – longed: the role as a societal partner
Describe your role as a societal partner within COSMOS.
➢ What did you do?
➢ How did you collaborate with the higher education institute?


<table><tr><td>Name one thing that made your heart beat faster in the COSMOS project.</td><td>Name one thing that you learned in the COSMOS project.</td><td>Name one thing you missed in the COSMOS project.</td></tr></table></td><td>Recording material
Padlet</td></tr>
<tr><td>3</td><td>Lessons learned
Zoom in on what you - as a societal partner - learned from the COSMOS project regarding:
• Open science education;
• School leadership & school organisational level;
• Your (as a societal partner) skills to collaborate towards a more open science education approach;
• Your (as a societal partner) capacities to facilitate students' and citizens' educational engagement with SSI.</td><td>Recording material
Mural</td></tr>
</table>

Project Partners

Utrecht University, Freudenthal Institute (Project Coordinator) The Netherlands

University of Southampton England

Karel de Grote University of Applied Sciences and Arts, Centre of Expertise in Urban Education, Belgium

Karlstads University, Research Centre SMEER (Science, Mathematics, Engineering Education Research), Sweden

University of Lisbon, Institute for Education, Portugal

Beit Berl College, Faculty of Education, Israel

Euroface Consulting, Czech Republic

Universiteits Museum Utrecht

Winchester Science Centre & Planetarium

Belgium

Alma Löv Museum, Sweden

Ciência Viva, National Agency for Scientific and Technological Culture, Portugal

Ministry of Education, Department. for Research and Development, Experiments and Initiatives