



D5.1 Teacher Professional Development Handbook

Guiding the first implementation round

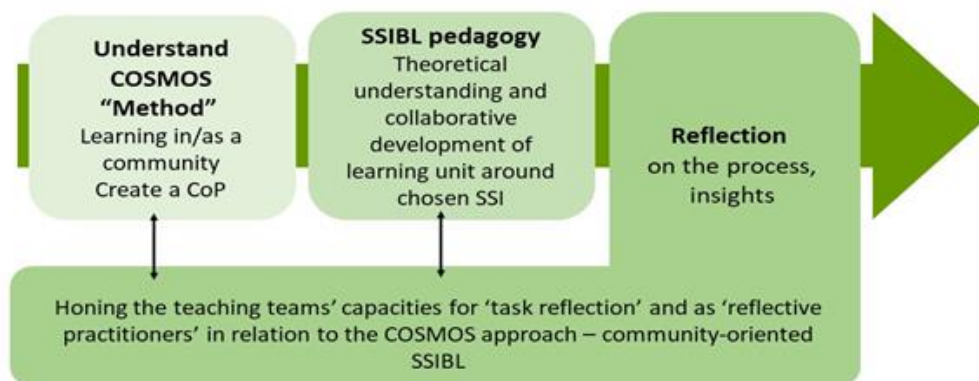


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Disclaimer:

- The TPD handbook is a WP5 deliverable in the COSMOS project
- This handbook is for use only within the COSMOS consortium and is not to be distributed outside the consortium without a document of agreement of the COSMOS executive Board.
- This handbook serves to guide the capacity building of school teams participating in the COSMOS project in the different countries during the first implementation round in the academic year 2022-23.
- The handbook will be further developed based on the experience gained after the first implementation round.
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Contents

Introduction.....	6
Section A. TPD Guidelines and Materials.....	7
Unit 1 – The COSMOS approach	11
1.1 "Recruiting" the school/s – Engaging the school with COSMOS.....	11
1.2 Assessing the school's openness – Focus group	17
1.3 Learning in and as a community Workshop.....	17
1.4 Suggested reading for Unit 1 – Understanding the COSMOS method	22
Unit 2 – 'Community-oriented SSIBL' pedagogy – How to select a SSI and develop a learning unit within a CoP	25
2.1 Understanding SSIBL and how conducting it within a CoP influences the three learning stages.....	27
2.2 Selecting a SSI and creating a CoP around it – COSMOS ASK, FIND OUT, ACT .29	
Unit 3 – Developing Reflective Capacities concerning the COSMOS Method.....	34
3.1 Honing reflective capacities	34
3.2 Assessing the school's openness – movement from inward to outward mode...39	
Section B. TPD Logistic Plan.....	40
Suggested TPD framework - what, who, when	40



Glossary

TPD	Teacher Professional Development
PD	Professional development
COSMOS	Creating Organizational Structures for Meaningful science education through Open Schooling for all
CoP	Community of Practice
CORPOS	Core ORganisational Structure for Promoting Open Schooling
SSI	Socio-Scientific Issue
SSIBL	Socio-Scientific Inquiry-Based Learning



Introduction

The aim of this handbook is to provide guidelines for the capacity building of school teams. Capacity building concerns developing a deep understanding of **learning in and as Communities of Practice and employing open (community-oriented) SSIBL** (Socio-Scientific Inquiry-Based Learning) as the pedagogical framework for developing (in Communities of Practice, CoP) learning units for science classes around relevant socio-scientific issues. Together, these comprise the COSMOS open schooling approach.

This handbook includes two sections:

Section A: TPD guidelines and materials (round 1 version) for applying the COSMOS method (CoP, SSIBL).

Section B: A TPD logistic plan (round 1 version) that provides an outline specifying the suggested timeframe, participants, and location of the TPD actions (local/national/transnational).

- The TPD guidelines and activities are generic and can be adapted for upper primary and secondary (junior high school) school levels.
- TPD activities suggested herein should be tailored to the openness attributes (see WP7 COSMOS openness assessment partner manual) of each participating school and the teachers' needs in these schools and should be co-constructed with the educational teams.
- Developing the professional pedagogical capacities of educational teams should be conducted in coordination with: (a) WP3 and WP4 activities, and (b) assessment actions (WP7).
- Adapting TPD guidelines to national/local context - HEI partners, in coordination with WP3 & WP4 are responsible for adapting the PD of educational teams (guidelines and materials and logistic plan) to each country and school context, based on the identification of the school team's needs and openness attributes.



Section A. TPD Guidelines and Materials

This guidelines and materials handbook provides an initial set of practice for the first implementation round. This handbook is a resource-in-progress - the guidelines will be refined and further developed based on the experience and insights gained during implementation round one. They will also be enriched with additional theoretical resources, as well as practical resources accumulated and adapted from the school teams during the implementation, reflecting co-construction with the school teams.

The materials include: (a) practical material - suggested learning activities for each stage of the PD and (b) theoretical material - suggested reading for establishing and deepening the knowledge foundation regarding the conceptual focuses of TPD (learning in & as a community, SSIBL).

TPD in COSMOS addresses three major components organized in 'conceptual stages':

- (1) COSMOS method/ approach - Creating an understanding, developing a mindset, and cultivating a professional identity concerning learning in and as a community.
- (2) SSIBL pedagogy - Understanding SSIBL and applying it, in the COSMOS context, in developing (within a CoP) and implementing a learning unit (or units) on a selected socio-scientific issue.
- (3) Reflection - Conducting a meaningful reflection of the process.

Some clarifications:

- While the suggested activities reflect a **sequential progression**, within each conceptual stage of PD the activities are modular; that is, the activities can be conducted as a stand-alone component of the PD process, and the order and specific application can be changed according to the contextual (i.e., school teams) characteristics and needs.



- The activities are suggestions we view as a starting point and it is expected that they will be modified (1) to suit specific contexts, (2) upon teachers' engagement in the co-design learning process.
- The activities can be conducted at the COSMOS school community level (groups of schools) or at the school level (the individual school team).
- While TPD concerns work with the science and other teachers who will be involved in COSMOS, corresponding with the COSMOS community approach we envision the participation of CORPOS members in the PD, thus to our understanding these guidelines can apply also to work with the CORPOS.



Overview of the TPD

Each unit is elaborated further on with suggested activities, comments for implementation and suggested reading.

TPD unit - conceptual focus	Aims	Suggested PD components of the unit
1. The COSMOS approach - learning in and as a community.	<ul style="list-style-type: none"> • Initiate the process of creating a mindset and professional identity (as a teacher, and a school) regarding the notion of 'open schooling' via communities of practice • Understand the educational benefits of learning in and as a community • Concretize how this plays out in practice in the social and physical context of the school 	<ol style="list-style-type: none"> 1. "Recruiting" the school/s - Engaging the school with COSMOS (whether with individual schools or in school groups) -- Familiarizing with COSMOS and creating motivation and a sense of identification with the idea of 'open schooling' in the context of science education. 2. Initial CORPOS Focus group assessing the school openness attributes - Conducting a reflective discussion on the school's current reality in relation to the openness dimensions, prioritize the dimensions - which of the dimensions will be addressed earlier, which later... 3. Learning in/as a community Workshop – Concretizing, in the context of COSMOS, basic elements that define a learning community: joint enterprise, mutual engagement, shared repertoire.
2. Community-oriented SSIBL pedagogy, developing a SSI learning unit within a CoP	<ul style="list-style-type: none"> • Understand the rationale and three stages of SSIBL and how these play out when conducted as a learning community. • Link the selecting of a SSI and establishing a community of practice around it. 	<ol style="list-style-type: none"> 1. Principles of SSIBL (based on PARRISE¹) toward inquiry-based learning in COSMOS 2. Selecting a SSI and starting to create a CoP around it - this TPD component reflects adapting the 'ASK' stage of SSIBL to COSMOS: it connects the process of identifying and selecting a SSI with starting to create a CoP [*].

¹ Levinson, R., Knippels, M.C., van Dam, F., Kyza, E. *et al.* (2017). *Science and society in education*. Socio-Scientific Inquiry-Based Learning: connecting formal and informal science education with society. (<https://www.parrise.eu/wp-content/uploads/2018/03/parrise-en-rgb.pdf>)

	<ul style="list-style-type: none"> • Provide support for the teachers during the process of (a) developing, within the CoP that has been established, a learning unit(s) on the selected SSI for implementation in science classes, (b) implementing the learning unit 	<p>[*] At the TPD stage, the CoP may begin to form, and it will continue to grow during the process of developing the learning units, as relevant & interested stakeholders are identified.</p>
<p>3. Reflection on the process</p>	<p>Improve the learning process:</p> <ul style="list-style-type: none"> • Selecting a SSI and designing an appropriate learning process for inquiring and addressing the SSI within a community [joint enterprise] • Identifying and selecting relevant partners for the CoP [joint enterprise, mutual engagement] • Engaging in a learning process that is based on participation and shared authority [mutual engagement] • Mediating different points of view within the CoP • Creating new knowledge as an outcome of the participation of diverse community members [shared repertoire] • Critically reflecting on instances that contributed or hindered the process of opening the school through SSIBL. 	<ol style="list-style-type: none"> 1. Reflection is included in activities of most of the different units. 2. Reflection processes are linked to assessment components (WP7), at the onset and end of the implementation and employ these as part of the reflective process (such as reflecting on the school's openness attributes). 3. Suggested generic framework supporting the educational teams' reflection skills

Unit 1 – The COSMOS approach

The first component (i.e., conceptual stage) of teachers' PD focuses on developing an understanding of and identification with the COSMOS approach /method – developing a COSMOS mindset in the aim of facilitating the school team's (and CORPOS) motivation to implement this in the school (and adopt this as part of the school's organizational culture)

Aims

- Initiate the process of creating a mindset and professional identity (as a teacher, and a school) regarding the idea of 'open schooling' via communities of practice
- Understand the educational benefits of learning in and as a community
- Concretize how this plays out in practice in the social and physical context of the school

Suggested PD components

This unit is comprised of three optional PD components. As stated above, a modular approach is adopted, thus, the PD activities are suggestions that can be adapted to the local or school-team context; and the choice of activities is left to the discretion of the partners depending on various factors, such as, the needs of the teams, the time available for TPD sessions, how the teams are progressing. Additionally, while COSMOS embraces the community approach by which it is beneficial to conduct some of the PD activities as a group/community of schools, they can also be conducted at the individual school level.

1.1 "Recruiting" the school/s – Engaging the school with COSMOS

Ideally, capacity building commences at recruitment (and with participation of CORPOS members); recruiting schools inherently involves initial elements of PD (such as familiarizing with COSMOS and its relevance and benefits for the school, initiating thinking in terms of COSMOS concepts, creating motivation or a sense of identification with the notion of 'open schooling') and can, thus, be utilized towards PD.



The activities described refer to recruitment that entails a 'call for candidacy' and selection process, but they can be conducted individually with schools joining the project based on previous partnerships. **Our use of the term "recruitment" also refers the recruiting of a mental process.** Accordingly, these TPD activities involve a process of familiarizing and engaging with the COSMOS method and understanding the contribution of entering the COSMOS change process. The activities can be conducted with a group of schools or with an individual school team.





Outline of 'Engaging the schools in COSMOS'			
	Content / Activity	Suggested duration	Material/ Resources
1.1 School recruitment call	The call for COSMOS contains some information on COSMOS Prior to Introductory meeting, request from the school a written statement: <i>Why is it important for your school to participate in this project?</i>	The call for COSMOS is optional, depending on the process of approaching schools; the request for a written statement is relevant for any school prior to the first meeting.	School Recruitment Call [in TEAMS]
1.2 Introductory meeting with schools as a group [f-2-f or long distance]	Presentation of COSMOS. After the meeting: Request for written statement: <i>Share information about the school that is relevant to the project</i>	1 hour: 30'- minute presentation, 30' Q's & A's about the project	Power point presentation 'Introducing COSMOS' [in TEAMS]
1.3 Workshop [F-2-F] - preferably with a group of schools, but also with an individual school team	Objective: Schools begin to think how COSMOS is relevant to science subject (science education) in their school. 1. Identify: In your school team identify a socio-scientific issue (e.g., environmental issue) that exists in your area that you see suitable as an issue for study in your school. Discuss with your team the following points: why did you select this issue? How does it relate to the science curriculum in your school? How does the community fit into this issue (creating/solving it)? If the workshop is conducted with a group of schools, include group sharing. 2. Crucial components of SE: Prepare a list of important components and attributes of learning science. Try and categorize these. Then choose which component/s (or attribute/s) is/are impossible to remove [which component/s learning science cannot do without]. Conduct a discussion around this. 3. Generic learning unit - Create a preliminary generic sketch of a learning unit that can be learned in your school and reflects	~2 hours: 1. Identify -- ~30' [school team & group discussion] 2. Crucial components in learning science -- ~15' [as a group] 3. Preliminary unit - ~30' [school team] 4. Thinking about partnerships - 30~ [as a group]	1. Identify table 2. Suggested learning unit table 3. 'Canvas' for mapping community partners



	<p>COSMOS principals as you currently understand them (unit aims, suggested content, suggested CoP members- teachers and from community)</p> <p>4. Partnerships - Canvas for mapping partnerships</p>		
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Materials for 'Engaging school/s with COSMOS' workshop

Identify [environmental] issue

Suggested [environmental] issue	Reasons for selecting this issue	Connections to science content in school	Community member/s & their role regarding the issue

Preliminary learning unit around selected environmental issue

Topic of unit	Content	Suggested CoP members from school staff	Suggested CoP members from community



Canvas for thinking about partnerships

Opportunities	Examples of previous experiences involving the community	Relevant community members
Challenges		Their role
How will learning science in your school look like when focused on socio-scientific issues and conducted within a learning community?		



1.2 Assessing the school's openness – Focus group

This component of PD employs the 'COSMOS openness assessment' manual (WP7 partner manual version).

If conducted as part of teachers' PD, it is suggested to include an additional component to the final Group Discussion.

Aim:

The aim of this additional component is to enhance the process of contextualizing COSMOS to the school, identify those dimensions the team sees most suitable and productive for addressing – i.e., prioritizing the attributes for practical purposes, and outlining an achievable '**horizon for change**' based on: (1) the present conditions - where we are now, (2) the future- where we aspire to get to, and (3) what needs to change. This is conducted as a discussion guided by the following points:

- Which of the eight dimensions of the school do you see feasible for changing (toward the outward mode) via your participation on COSMOS?
- Which of these dimensions correspond with the school's [formal] vision, with other projects the school is involved in or promoting, with specific challenges confronting the school community that are important to address?
- What is our Horizon - How do we envision the school, regarding these dimensions, at the end of the COSMOS process – where would we like to be regarding these dimensions?
- What needs to change (and can we change) in order to reach the new conditions?
- What important things/features should be kept?

1.3 Learning in and as a community Workshop

The purpose of this workshop is to deepen the developing of a COSMOS "mindset". Participants will begin to understand what learning in and as a community is about, what are the educational benefits of learning in a CoP as well as the challenges. The workshop communicates (concretizes) the essence of a CoP as a learning community and the basic concepts of CoP to the teachers (and



possible CORPOS members) participating in the project, without explicitly using these terms. This is achieved through the specific **goals**:

- Discuss what it means to learn in and as a community
- Think about the educational importance of a community-based learning process
- Become familiar with and gain an understanding of central concepts of a community-of-Practice: joint enterprise, shared repertoire, mutual engagement.

This workshop is based on Etienne Wenger's theory of social learning (Wenger, 2000) , which **identifies CoPs as the basic units of social learning systems**, and identifies **three basic concepts of CoPs**: *Joint enterprise, Mutuality/mutual engagement, and shared repertoire* which together address how the members understand what brings them together as a community, how decisions are made, how the participants understand their roles and responsibilities in the learning community, and how they interact and negotiate their mission, roles, and responsibilities. These three elements define the **competence** of CoP.

Joint enterprise: The CoP's collective developed understanding of what their community is about; CoP members hold each other accountable to this sense of joint enterprise. **Competence** is the understanding of the enterprise well enough to be able to contribute to it.

Mutuality/ mutual engagement – The norms and relationships established regarding the interactions among CoP members.

Shared Repertoire – The pool of resources that the members bring into the CoP – language, routines, sensibilities, artifacts, tools. Stories, styles, etc. To be competent is to have the access to this repertoire and to be able to use it appropriately.

The interplay of competence and experience via the member's mutual engagement is what forms the CoP. CoPs offer the opportunity to negotiate competence through the experience of direct participation. The competence of the specific CoP, which has emerged from the combination of



these three elements, and defines the specific CoP, makes the CoP a social unit of learning even in the context of larger systems. Essentially, the large systems are collections of interrelated CoPs.

Suggested duration – ~ 120'.

Learning environment – Room with tables for working in small groups

Materials required: A3 or A4 paper; Different coloured paper circles; Black markers; Sticky notes.



Part	Activities	Duration	Materials
<p>Part One -</p> <p><i>Joint enterprise</i> - What are the common goals that bring us together as a learning community</p>	<p>This part is two activities:</p> <p><u>Activity 1</u>: Attributes of learning in/as a community</p> <p>Question: Think about what it means to learn in a community? or, what are the characteristics of learning in a community</p> <p>Individual: Participants are given 4-6 paper squares of different colours, on which they write an attribute they perceive as an important aspect of learning in a community. They place the squares on a sheet of paper and connect among them with arrows that clarify, to their understanding, relations among these attributes, components, or concepts.</p> <p>Options:</p> <p>(1) Participants explain the reasoning for their choices. Discuss similarities & differences among the different ways the participants perceive learning in a community, or they defined the attributes of learning in a community.</p> <p>(2) A group sharing is not conducted now. At a later stage the participants will return to their product of this first activity.</p> <p><u>Activity 2</u>: Common goals</p> <p>Questions: What brings us to work together? What do you identify as the major aims of COSMOS?</p> <p>Individual work: The participants write the goals on different coloured sticky notes.</p> <p>* Collect sticky notes on a board or write the goals on the board.</p> <p>Group Discussion to extract and formulate common goals: Identify similar goals; Group the goals into categories; Provide a title for each category. Is something important missing?</p> <p>Have we identified a set of goals that are common to us as a professional learning community [around COSMOS]?</p>	<p>Activity 1: ~15-20</p> <p>Activity 2: ~15-20</p>	<p>Different coloured sticky note; A3 papers</p>
<p>Part Two -</p> <p><i>Mutual engagement</i>- What are my motivations? What do I learn in this community?</p>	<p>Questions: Why are you in the COSMOS project? What are your goals or motivations for taking part in the project? What do you aspire to gain from participating?</p> <p>1. Individual work</p> <p>2. Group – Share (Create a "bank" of motivations/ individual goals). Discuss the individual motivations; Are there similar / different motivations? Categorize the pool of motivations into groups (for example, conceptual, instrumental, ethical, etc.)? How do these motivations relate to each other? How do they relate to the set of common goals from the previous activity?</p>	<p>~20- 30'</p>	<p>A3, A2 paper; paper circles</p>



<p>Part Three -</p> <p>Shared repertoire -</p> <p>Identifying shared and joint knowledge the participants bring into the COSMOS project and contribute to achieving it goals</p>	<p>Activity: The participants return to the product of the first activity. They are requested to see if, following the previous discussions and ideas that came up in these discussions (and from other participants), they would add additional attributes or change the relationships among the attributes.</p> <p>Alternative activity:</p> <p>Group: Look at the set of common goals we created as a group. Create a list of requirements for achieving these goals; group these into categories.</p> <p>Individual: How do you see yourself contributing to achieving these goals - what can you bring in towards achieving these goals?</p>	<p>~15'</p>	
<p>Summary - Reflecting on the workshop</p>	<p>Individual: The participants are requested to reflect on the workshop around the following points: What was the aim of this workshop to your understanding? What did we do in these activities? What transactions took place? What are your insights from the activities (individual and discussions) - what did you learn about the group as a learning community and yourself as a member? What challenges do identify for the group? What are your ideas for overcoming these challenges?</p> <p><u>Summary</u> (suggest conducting explicitly after participants share their ideas):</p> <p>We used the knowledges, modes-of-thinking and perspectives of each of the participants, as a shared resource - a shared repertoire - to create a common understanding of our group as a learning community around COSMOS.</p> <p>Part 1: We defined the meaning and essence of learning in/as a community using the different understandings and perspectives each of us contributed toward defining a set common goal/s of COSMOS. Achieving these goals is our <i>joint enterprise</i> - what characterizes our specific [COSMOS] professional learning community.</p> <p>Part 2: By looking at each of our [as members of the COSMOS CoP] individual motivations and discussing the relationships among them, we began to think how we engage among - our terms/norms of <i>Mutual engagement</i> - as a learning community toward achieving its goals.</p> <p>Part 3 further contributed to this [mutual engagement] by thinking about how each of us can contribute to fulfilling the requirement needed to achieving COSMOS aims as well as fulfilling our individual goals in this project. This pool of our contributions creates our <i>shared repertoire</i> - the combined knowledge, perspectives, skills, etc. of our group towards achieving our joint enterprise.</p>	<p>~15'</p>	

1.4 Suggested reading for Unit 1 – Understanding the COSMOS method

Mezirow, J. (2003). Mezirow, J. (1997). Transformative learning: Theory to practice. *New Directions for Adult and Continuing Education*, 1997(74), 5–12. <https://doi.org/10.1002/ace.7401>.

Mezirow, J. (2003). Transformative learning as discourse. *Journal of Transformative Education*, 1(1), 58–63. <https://doi.org/10.1177/1541344603252172>

Senge, P., Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Kleiner, A. (2012). *Schools that Learn: A Fifth Discipline Fieldbook for Educators, Parents, and Everyone Who Cares about Education*. New York: Crown Publishing Group. Available online at: [https://www.tnteu.ac.in/pdf/library/School_Education/7%20%20Schools%20That%20Learn_%20A%20Fifth%20Discipline%20Fieldbook%20for%20Educators,%20Parents,%20and%20Everyone%20Who%20Cares%20About%20Education%20\(%20PDFDrive%20\).pdf](https://www.tnteu.ac.in/pdf/library/School_Education/7%20%20Schools%20That%20Learn_%20A%20Fifth%20Discipline%20Fieldbook%20for%20Educators,%20Parents,%20and%20Everyone%20Who%20Cares%20About%20Education%20(%20PDFDrive%20).pdf)

- Suggest section II (p. 92) A Primer on the five Disciplines. These include:
 - 'Shared Vision' (p. 111; see Key Questions for a Shared Vision, p.122);
 - 'Balancing Advocacy and Inquiry' (p. 136; see 'conversational recipes for cultivating skills of balancing advocacy & inquiry', p. 137; see the 'advocacy/inquiry palette', p. 139;
 - 'Team learning' (p. 149) (see 'Mind-mapping techniques/associative conceptual diagrams' p. 157; and "World Café", p. 159). 'Systems Thinking' (p. 160) with suggested exercises

Sterling, S. (2010–11). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education*, 5, 17–33.

Wals, A.E.J. (2007). *Social learning towards a sustainable world – Principles, perspectives, and praxis*. Netherlands: Wageningen Academic Publishers

Wenger, E. (2002). Communities of practice and social learning systems. *Organization*, 7, 225-246. doi: 10.1177/135050840072002

Wenger, E. & Wenger-Trayner, B. (2015). Introduction to Communities of practice: A brief overview of the concept and its uses. Available at: <https://www.wenger-trayner.com/wp-content/uploads/2022/06/15-06-Brief-introduction-to-communities-of-practice.pdf>

Following is an annotated list of these references.



Suggested reference	Brief look at the reference's relevance for TPD in COSMOS
<p>Mezirow, J. (2003). Mezirow, J. (1997). Transformative learning: Theory to practice. <i>New Directions for Adult and Continuing Education</i>, 1997(74), 5–12. https://doi.org/10.1002/ace.7401.</p>	<p>Mezirow looks at changing individuals' frames-of-reference as an essential component of transformative learning.</p>
<p>Mezirow, J. (2003). Transformative learning as discourse. <i>Journal of Transformative Education</i>, 1(1), 58–63. https://doi.org/10.1177/1541344603252172</p>	<p>One of the two major aims of COSMOS is changing the organizational culture of the school [toward an 'openness mode']. This essentially entails a transformative learning process of the school team (as well as the CORPOS and the CoP established around the Selected SSI), which entails changing the frames-of-reference of the teachers.</p>
<p>Sterling, S. (2010–11). Transformative learning and sustainability: Sketching the conceptual ground. <i>Learning and Teaching in Higher Education</i>, 5, 17–33.</p>	<p>Stephen Sterling elaborates on Mezirow's theory of transformative learning in the context of different orders of learning (first order, second order and third order) and how they relate to change, which is the aim of transformative learning.</p>
<p>Wenger, E. (2002). Communities of practice and social learning systems. <i>Organization</i>, 7, 2002. doi: 10.1177/135050840072002.</p> <p>Wenger, E. & Wenger-Trayner, B. (2015). Introduction to Communities of practice: A brief overview of the concept and its uses.</p>	<p>Etienne Wenger's theory of social learning which identifies Communities of practice as the basic unit of social learning.</p>
<p>Senge, P., Cambron-McCabe, N., Lucas, T., Smith, B., Dutton, J., & Kleiner, A. (2012). <i>Schools that Learn: A Fifth Discipline Fieldbook for Educators, Parents, and Everyone Who Cares about Education</i>. New York: Crown Publishing Group.</p> <p>Suggest section II (p. 92) A Primer on the five Disciplines. These include:</p> <p>'Shared Vision' (p. 111; see Key Questions for a Shared Vision, p.122);</p> <p>'Balancing Advocacy and Inquiry' (p. 136; see 'conversational recipes for cultivating skills of balancing advocacy & inquiry', p. 137; see the 'advocacy/inquiry palette', p. 139;</p> <p>'Team learning' (p. 149) (see 'Mind-mapping techniques/associative conceptual diagrams' p. 157; and "World Café', p. 159).</p>	<p>Peter Senge is a central thinker on organizational learning. This book (download via the link) focuses on organizational learning of schools. All of the "five disciplines" (attributes) (personal mastery, shared vision, mental models, balancing advocacy and inquiry, team learning) of learning organizations are essentially relevant to the organizational change that COSMOS aspires for. Three are directly relevant: <i>shared vision</i> complements Wenger's 'joint enterprise', <i>balancing advocacy and inquiry</i> is a complementary approach to Wenger's 'mutual engagement' as it looks at how the members negotiate and manage their interactions, <i>team learning</i> is basic to CoPs as learning communities.</p> <p>The five disciplines (attributes) complement Michael Fullen's attributes of teachers as agents of change. Furthermore, Senge's theory of learning organization also addresses</p>



'Systems Thinking' (p. 160) with suggested excersizes

the role of leadership, complementing Fullan's approach to educational leadership (see ref. Or WP2 – COSMOS Frameowork)

The Senge et al fieldbook offers activites and excersizes for each of the disciplines (see reference to these) which can be implemented as additional TPD activities.

Unit 2 – 'Community-oriented SSIBL' pedagogy – How to select a SSI and develop a learning unit within a CoP

The second component (i.e., conceptual stage) of teachers' PD reflects the adaptation of SSIBL's three stages (ASK, FIND OUT and ACT) to the COSMOS method. This entails developing the teachers' capacities concerning the process of identifying a SSI for study and creating a CoP around this SSI for the development and implementation of a science learning unit (or units). In COSMOS, identifying an authentic and locally relevant socio-scientific issue for study ('ASK' stage of SSIBL) is ideally conducted within a community – preferably including CORPOS members and possibly other relevant stakeholders, who, together, as a community of practice, identify and frame questions. TPD entails developing teachers' capacities for leading and brokering this process.

In COSMOS, the FIND OUT (inquiry) stage will be influenced by the CoP members, who contribute perspectives, content and methods for the inquiry-based learning concerning the SSI. This is expected to enrich the inquiry process and its outcomes. Resultant of this, it is expected that the ACT stage will reflect a more comprehensive and multidimensional approach to addressing the various problems [aspects] that comprise the socio-scientific issue.

Aims:

- Understand the rationale and three stages of SSIBL (ASK, FIND OUT, ACT) and how these play out when conducted within CoP.
- Cultivate the capacities to mediate the selection of a SSI and the process of creating a community of practice around the SSI ('ASK').

Note

The following aims concern WPs3 & 4 but require guidance and support of the teachers throughout the development and implementation of the learning units.

- Develop, within the CoP that has been established, a learning unit(s) on the selected SSI such that the learning unit reflects the input of those CoP members who are directly involved in designing the unit.
- Implement the learning unit



Outline of Unit 2 TPD				
	Aim	Content focus	Suggested duration	Materials
2.1 SSIBL pedagogy	Understand the rationale and three stages of SSIBL (ASK, FIND OUT, ACT) and how these play out (are influenced) when conducted as a learning community.	Principles of SSIBL (based on PARRISE ²) toward inquiry-based learning in COSMOS. Overview of SSIBL pedagogy with the presentation and discussion how the three stages may be influenced when conducted as a community	1.5 hours	SSIBL pedagogy presentation [in TEAMS]
2.2 COSMOS 'ASK'	Develop teachers' skills for leading the process of selecting a SSI and creating a CoP around it Developing brokering/mediating capacities for SSIBL ASK, FIND OUT, ACT	Selecting a SSI and creating a CoP around it - connecting the process of identifying a SSI with creating a CoP	~2 hours	Table framing a methodology for thinking with guiding and reflection questions

² www.parrise.eu

2.1 Understanding SSIBL and how conducting it within a CoP influences the three learning stages

This PD component provides the foundations (conceptual and practical) for implementing SSIBL in the context of COSMOS.

This PD component focuses on:

- (1) Understanding what comprises a socio-scientific issue and what characterize SSIs.
- (2) Understanding the rationale and aims of the SSIBL model (developed in the PARRISE project): ASK – selecting a relevant SSI, mapping it as a multidimensional and controversial issue, and formulating questions for investigation; FIND OUT – Inquiry-based investigation of the questions; ACT – Taking socially-responsible action on the issue based on the inquiry findings.
- (3) Demonstrating with the teachers (engaging them) learning activities on which SSIBL is based (e.g., mapping the controversies, the stakeholders and their positions relating to the SSI and debates that arise from these) - **scaffolding their skills to implement the process with their students.**
- (4) Discussing how conducting the process within a CoP influences (enriches) each of the SSIBL learning stages.

The **resource** for this PD component is a **generic** power point presentation ('SSIBL pedagogy for TPD handbook round 1') that introduces the SSIBL model (three learning stages), goes through the different stages, each in which it provides examples of content, some suggested activities and guiding questions supporting the teachers' capacities to guide activities, and raises discussion how conducting SSIBL within a CoP may influence each of the stages.

This is a **generic resource**. It is required that you **adapt it to your context** in terms of (1) the content, specifically the example SSIs, so they are contextually (i.e., geographically, students' age-level) relevant, (2) the teachers interests and capacities, (3) the time available for investing in this PD component. Not all of the slides are crucial - the presentation includes enrichment slides.



Suggested reading and enrichment sources:

The PARRISSE framework. Available at: <https://www.parrise.eu/>

Amos, R., & Christodoulou, A. (2018). Really working scientifically: strategies for engaging students with socio-scientific inquiry-based learning (SSIBL). *School Science Review*, 100(371), 59-65

Amos, R., & Levinson, R. (2019). Socio-scientific inquiry-based learning: An approach for engaging with the 2030 Sustainable Development Goals through school science. *International Journal of Development Education and Global Learning*, 11(1), 29-49. DOI <https://doi.org/10.18546/IJDEGL.11.1.03>

Amos, R., Knippels, M.C. & Levinson, R. (2020). Socio-scientific inquiry-based learning: possibilities and challenges for teacher education. In: J. Dillon, M. Evagorou and J.A. Nielsen (Eds), *Science Teacher education for responsible citizenship: towards a pedagogy for relevance through socio-scientific issues*. Springer, (pp. 41-61). <https://www.springer.com/gp/book/9783030402280>

Ariza, M. R., Christodoulou, A., Harskamp, M. V., Knippels, M. C. P., Kyza, E. A., Levinson, R., & Agesilaou, A. (2021). Socio-Scientific Inquiry-Based Learning as a Means toward Environmental Citizenship. *Sustainability*, 13(20), 11509.

Knippels, M.C., & van Harskamp, M. (2018). An educational sequence for implementing socio-scientific inquiry-based learning (SSIBL). *School Science Review*, 100(371), 46-52.

Levinson, R., Knippels, M.C., van Dam, F., Kyza, E., Christodoulou, A., Chang-Rundgren, S.N. et al. (2017) Socio-Scientific Inquiry-Based Learning: connecting formal and informal science education with society. Available at: www.parrise.eu/wp-content/uploads/2018/03/parrise-en-rgb.pdf

Levinson, R. (2018), Introducing socio-scientific inquiry-based learning (SSIBL). *School Science Review*, 100(371), 31-35.

Suggested resources for TPD



Outline of a workshop course and lesson plans for TPD sessions on SSIBL (University of Southampton, in the PARRISE project, EU:

https://www.parrise.eu/wp-content/uploads/2017/12/Outline_LessonPlans_SOTON.pdf

PPT presentations of a TPD program on SSIBL conducted at the University of Southampton within the PARRISE project, EU: <https://www.parrise.eu/wp-content/uploads/2018/02/TPD-presentations.pdf>

Resources of TPD programs (outline, PPT presentations) on SSIBL (Utrecht University, in the PARRISE project, EU: https://www.parrise.eu/teacher_pd/ssibl-courses-at-utrecht-university-freudenthal-institute/n

Teacher training materials prepared by partner institutions in the PARRISE project, EU: [TPDs – PARRISE | Promoting Attainment of Responsible Research and Innovation in Science Education](https://www.parrise.eu/teacher_training_materials/) https://www.parrise.eu/teacher_training_materials/

2.2 Selecting a SSI and creating a CoP around it – COSMOS ASK, FIND OUT, ACT

While this can be conducted as a distinct TPD activity, in practice selecting the SSI and creating the CoP is a component of implementation (WPs 3,4). The process of selecting a SSI and creating the CoP around it is emergent; there is no one "recipe" for this process. It may take different courses depending on the teachers that are involved - the ideas they raise, they different actions they may take in the process of selecting and engaging various stakeholders as a CoP. Insights concerning best practices of this process need to be obtained from the experience of the teams in the first implementation round.

Aim:

Scaffolding the teachers' capacities to lead and mediate/broker SSIBL within a CoP by raising awareness to various considerations in the combined process of selecting a relevant SSI and establishing a CoP around the issue.

The following tool is not a structured learning activity with the teachers but offers a generic framework of questions to be considered that support the teachers' capacities to **lead and**



mediate/broker the process. In the previous (2.1) TPD component teachers have engaged in some of these questions.



Component	Guiding questions	Aspects for reflection
<p>Selecting an authentic SSI</p> <p>(Part of ASK)</p>	<p>? What is an authentic SSI - What makes an issue authentic and socio-scientific?</p> <p>? How does the process of selecting a SSI look like – is it pre-determined (e.g., by one of the teachers or a CORPOS member) or an emergent process?</p> <p>? Who decides the SSI: What kinds of inputs are needed from the community, including the students (in-school and/or out-of-school) when selecting an SSI? Who can we involve in the process of selecting the SSI?</p> <p>? How can I, as a teacher, involve the CORPOS in the process of selecting the SSI? Does the CORPOS decide on a general issue which is the made more accurate by CoP members?</p> <p>? How can the students be involved in selecting the SSI?</p> <p>? Does the process you experienced resonate with the outcome of the openness assessment and the aims that emerge from that</p> <p>More questions to consider?</p>	<ul style="list-style-type: none"> ☛ What is important to look at when selecting an SSI? How does it relate to the science curriculum conducted in the school? ☛ Is it important that everyone agrees on the same SSI? Should a democratic process (e.g., voting) be employed? ☛ What should I/we do with those who do not "connect" to the issue – How do we promote their motivation to be engaged if they don't affiliate with the selected SSI? ☛ How can I/we promote more critical attitudes regarding the social environment via the selection process? ☛ How do I/we promote student and community member motivation for engaging in the issue? ☛ What happens with myself/other teachers/students when the selection process is shared among community members? ☛ What could have been done differently in the selection process that could have produced better results? <p>More points to reflect on?</p>
<p>Mapping the SSI - framing it for inquiry –</p> <p>(Part of ASK)</p>	<p>? What are the different lenses to look at the selected SSI?</p> <p>? What are the controversies / dilemmas involved in the SSI? Who are the stakeholders in this SSI and what are the interests of each stakeholder? What are the different / conflicting interests involved in this SSI?</p> <p>? What are the various inquiry questions that this SSI raises? Which questions facilitate 'good' (meaningful) learning?</p>	<ul style="list-style-type: none"> ☛ How do we ensure that all the central lenses (scientific-environmental, social, economic) are taken into consideration in the framing of the SSI? ☛ How can I mobilize the school community (to the CORPOS or other in-school and out-of-school members) to contribute to the mapping of the SSI (framing it for inquiry)?

	<p>More questions to consider?</p>	<ul style="list-style-type: none"> • What kinds of questions facilitate meaningful learning? How can we select among different questions • How do I feel regarding possible lack-of-knowledge in the different lenses of this SSI? <p>More points to reflect on?</p>
<p>Recruiting a CoP and identifying (mapping) its members & engaging them</p>	<ul style="list-style-type: none"> ? What kinds of knowledges (e.g., content, method) are needed to address the SSI? ? Who can contribute from the in-school community (other teachers, families)? How can the CORPOS contribute? ? How do I/we approach and engage out-of-school stakeholders (to be a member of the CoP) ? How can the students be engaged as active participants of the CoP? ? What knowledge can each CoP member contribute? What can each bring into the process? ? Are additional community members needed (relevant to the CoP of the learning process)? What can each bring into the learning process? ? How to engage SSI stakeholders in the learning process? ? Who is actively involved in designing the learning process? Who supports the community from the outside – as an external source of information? ? What is the role of each member of the community? Who does what? 	<ul style="list-style-type: none"> • What is the best way to involve members and how to facilitate the process to them? • What need be considered when approaching stakeholders? What is the best way to involve each member and how should the process be presented/explained to them? • How does the CoP members involvement effect the learning process of the other members? • Do we need additional information / stakeholders for addressing the SSI? • What are the gains and price of extending membership? • Do all the CoP members feel they are contributing to the process? Are they aware how their participation in the CoP contributes to them?

<p>Brokering the process.</p> <p>This is exemplified for FIND OUT; Questions can be adapted to pertain to the ACT stage</p>	<p>? What do the CoP members or stakeholders need to know in order to contribute to the inquiry-based learning process? Do they know their role (contribution) and is the process clear to everyone involved?</p> <p>? How to communicate the process to non-educational members / stakeholders?</p> <p>? What can each CoP member contribute to the inquiry (in terms of content, methods, etc.)? What can each bring into the process?</p> <p>? Is additional information (including stakeholders) needed for inquiring the inquiry questions the emerged from the SSI (and possibly during the inquiry itself)</p>	<p>Brokering the learning process connects to the 'FIND OUT' stage of SSIBL. In COSMOS, the aim is 'SSIBL via CoP'. Following are points for reflection regarding SSIBL via CoP:</p> <ul style="list-style-type: none"> • Is the inquiry process clear to everyone? Do all community members know their role in the process? • Do all community members feel they are contributing to the inquiry-based learning process? • How to address tensions or disagreements that may arise among SSI stakeholders involved in the inquiry process? • Are they aware of how other community members contribute to them? • Are the students engaged in the process? What are the dynamics among the students and what brokering strategies need to be taken to lead to more effective and deep learning?
<p>Additional for ACT</p>	<p>? How do we support students in taking action?</p> <p>? What strategies do we put in place to support that the pledges for action materialize?</p> <p>? Have we revisited the actions that were planned?</p>	<ul style="list-style-type: none"> • Do the actions being undertaken feel uncomfortable to any of the CoP members? Does their need to be consensus on the kinds of actions being taken?
<p>Whole SSIBL process</p>		<p>Reflection on the whole process - See Unit 3 reflection activity (a)</p>

Unit 3 – Developing Reflective Capacities concerning the COSMOS Method

As part of the capacity-building activities of the COSMOS project, TPD actions will focus on honing teachers' reflective thinking competences particularly as these pertain to teaching and learning in and as a community. Reflection – as an activity - is embedded and promoted throughout the various TPD activities in the project and should be encouraged throughout the various design and implementation stages. In this unit, TPD actions are specifically aimed at gaining a better understanding of the process as a whole in two main respects: (1) developing the skills and competences for designing and implementing science education communities of practice (*task-reflection*); (2) developing and enhancing Open Schooling mindsets and teachers' professional identity as 'reflective practitioners' (*self-reflection*). These two aspects are entangled and mutually support each other in this unit's activities.

To promote these two PD aspects, Unit 3 offers two tools (preferably one after the other):

- (1) The first tool offers a generic framework for supporting educational teams' reflective questioning activities organized according to central principles of the COSMOS method and the three main attributes of CoPs (joint enterprise, mutual engagement, shared repertoire) addressed in Unit 1.
- (2) The second is a return to the openness dimensions and conducting a reflective process around these movement of the school from a more inward to more outward position in these dimensions between the initiation stage and the end of implementation.

Additional reflection tools will be developed employing later other assessment components that will be developed within WP7.

3.1 Honing reflective capacities

The following tool can be applied in a single "reflection" session. The appropriate timeframe for this session is between 1 - 1.5 hours. This activity is aimed at teachers who directly participated in



the various stages of the design and implementation of the SSI-CoP. Having said that, the participation of others is definitely advisable – certainly CORPOS members, who will possibly be responsible for promoting and engaging in reflective activities during and after the project lifecycle. The sequence of reflective questions offered here are suggestions for dialogue and conversation and can be modified (together with educational teams) to accommodate the specific educational context. The final question in each section should be the last to be addressed.



COSMOS principles	1. CoP attributes (see Learning in and as a Community Workshop)	Questions directing reflective activities with educational teams In hindsight or after the fact:
Selecting an SSI and designing an appropriate learning process for inquiring and addressing the SSI within a community	Joint enterprise	<ul style="list-style-type: none"> • Was the SSI selected meaningful to all participants? Was the SSI sufficiently authentic: was it relevant to all learning community members? • Was the SSI a fruitful issue: one that involves various and conflicting stakeholders (namely, a wicked problem)? one that initiated meaningful questions for inquiry? • Was the SSI selected age appropriate? • How much were the partners/stakeholders involved in the SSI selecting and design process? Could the process be more fruitful if other stakeholders were involved? Conversely, was the involvement of multi stakeholders in the selection and design process useful and contributing? • What could I/we have done differently in the selection and design process to make the learning more meaningful and educating for all learners? What did I learn from this experience? • Contribute more questions
Identifying and selecting relevant partners for the CoP	Joint enterprise	<ul style="list-style-type: none"> • Throughout the stages of CoP design and implementation, what were the contributions of the 'external' stakeholders to the learning process? Could these contributions be enhanced? • How did the in-school community contribute to the process? Were teachers of other subjects involved? Did the CORPOS contribute to the process? If not, how could I/we have engaged the CORPOS? • Was it possible/desirable to add more stakeholders/partners to the community during the FIND OUT stage? • What could I have done differently in the partner identification and selection process to promote more rich and meaningful learning experiences? What did I learn from this experience?

		Contribute more questions
Engaging in a learning process that is based on participation and shared authority	mutual engagement	<ul style="list-style-type: none"> • Was there sufficient participation by all involved in the learning process? How was the nature of participation (frequency, authenticity, level)? • Were there voices that were not heard or muted as a result of the design of the learning process? • Who was involved in decision making processes throughout the process? Were others (besides myself) part of the decision-making process? • What could I have done differently to promote more participation and engagement? How did I feel or experience my authority as a teacher in the CoP and did this experience change in any way my understanding of teacher authority or responsibility? <p>Contribute more questions</p>
Mediating different point of view within the CoP	Mutual engagement/Shared repertoire	<ul style="list-style-type: none"> • How much conflict (in point of view, interests) was experienced among the partners/stakeholders? Was conflict an issue that needed more attention? How were these disagreements addressed - were they conflicts properly handled? • Were the participants able to share their ideas freely and was I able to bridge gaps in understanding, point-of-view or approaches to addressing problems that arose in the design and learning process? • Was I sufficiently attentive and sensitive to opposing views or gaps in the understanding? Were minority views expressed and properly addressed? • What could I have done differently to promote better communication among community members and more engagement particularly between diverse community members? What did I learn about myself as a mediator of different individuals and points of view? <p>Contribute more questions</p>

<p>Creating new knowledge as an outcome of the participation of diverse community members</p>	<p>Shared repertoire</p>	<ul style="list-style-type: none"> • What do the students know after learning in the CoP? How can I/we assess the knowledge that was acquired-created? • Did all the community members contribute knowledge? Did different community members contribute different types of knowledge? Was the knowledge created evenly distributed and dispersed among all community members? • Was the knowledge created appropriate for conducting the inquiry-based learning (FIND OUT)? For taking action/addressing the SSI (ACT)? • Was it possible to gain the knowledge created in 'regular' classroom activities? Did the participation of community members enable richer and more diverse types of inquiry? • What new knowledge did I acquire? What new knowledge did the community members benefit? What benefits do the community members identify for themselves from the process? • What could I have done differently to promote further knowledge? What would I do differently in future CoPs?
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3.2 Assessing the school's openness – movement from inward to outward mode

This assessment component of PD employs the 'COSMOS openness assessment' focus group manual (WP7 partner manual version- focus group at the end of implementation).

Aim:

The aim of this additional component to the focus group points of discussion is to reflect on achieving the **Horizon** identified/envisioned by the team as a result openness attributes at the onset of implementation, reflect how to improve practice, and future development. This is conducted as a critical discussion guided by the following points:

- **Realizing the Horizon** - How do we feel regarding the Horizon we envisioned at the onset of the process? In which of the dimensions is change more evident, in which- less?
- **Impact of conducting as a community** - How did working the process of working as a community of practice contribute to the different dimensions? What challenges did we encounter and how did we address these?
- **CORPOS** - What role did the CORPOS play in the process? How did it contribute? How did it benefit? What roles can the CORPOS play in an ongoing process?
- **Strengthening the school as a community** - In what ways did the process align with the school's vision? Has it contributed to addressing specific challenges confronting the school community? Has it opened new venues for learning?
- **What is our new Horizon** - regarding dimensions that were the focus of the implementation, and other dimensions? Can we identify new dimensions? What important things/features should be kept? What needs to change (and can we change) in order to reach the new conditions?



Section B. TPD Logistic Plan

Suggested TPD framework - what, who, when

The logistic plan organizes the conceptual stages of PD (what- content focus) along a timeframe (when) and in relation to the participants (who).

What –

TPD is organized around three **conceptual stages** (elaborated in Section A - Guidelines and Materials).

- (1) The first stage focuses on the COSMOS "method"/ approach – developing an understanding of learning in and as a community; cultivating in the teachers and school a COSMOS mindset and identity.
- (2) The second stage focuses on capacity building for developing, within a CoP, a learning unit (or units) on a locally relevant SSI implementing SSIBL pedagogy. This entails understanding the SSIBL pedagogy in the context of COSMOS.
- (3) The third stage of PD is concerned with reflecting on the process towards insights for improving the process, strengthening the capacities of school teams, and sustaining COSMOS in the school (the latter is tied to position/role of CORPOS within the school organization).



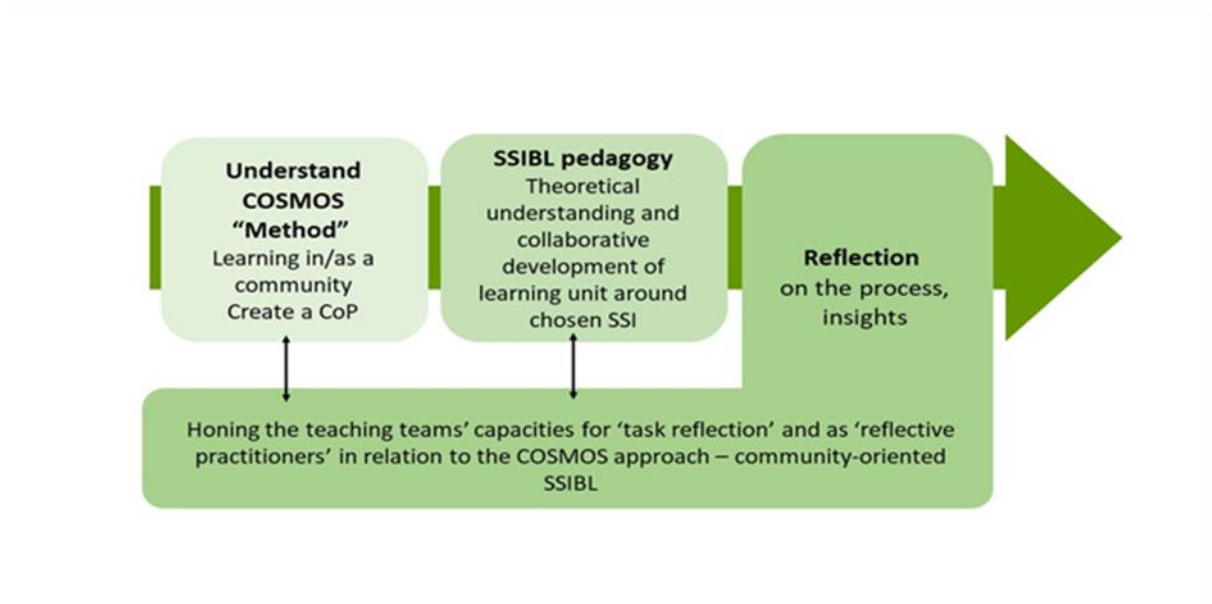


Figure 1. The three conceptual stages of TPD in COSMOS

Who -

Ideally, TPD is envisioned as being conducted in three **arenas** in terms of the participants:

COSMOS School Community arena (level) – This level entails encouraging (and supporting) creation of a community of schools that together comprise a **professional community of learning**. This may occur at a country level- in the case that there are several schools in the country participating in the implementation round. Conducting part of the TPD in a community of schools is a desirable situation as it enables exposure and enrichment of diverse perspectives and ideas; it epitomizes the essence of COSMOS. Creating a 'COSMOS School Community' may also occur internationally (international COSMOS school community) in the case that there are school teams who aspire to be part of an international professional community of learning. It may also occur with individual teachers who are motivated to being part of such a group.

School arena (level)- The school team participating in the implementation round, including the principal, CORPOS members, participating teachers, and possibly members of the CoP established around the SSI.

Individual Teacher arena (level)– Individual work with the teachers involved in the project (providing guidance and support addressing ad-hoc questions, challenges and problems that arise during the different stages the teachers are at in the implementation round, most likely mainly during the implementation stage).

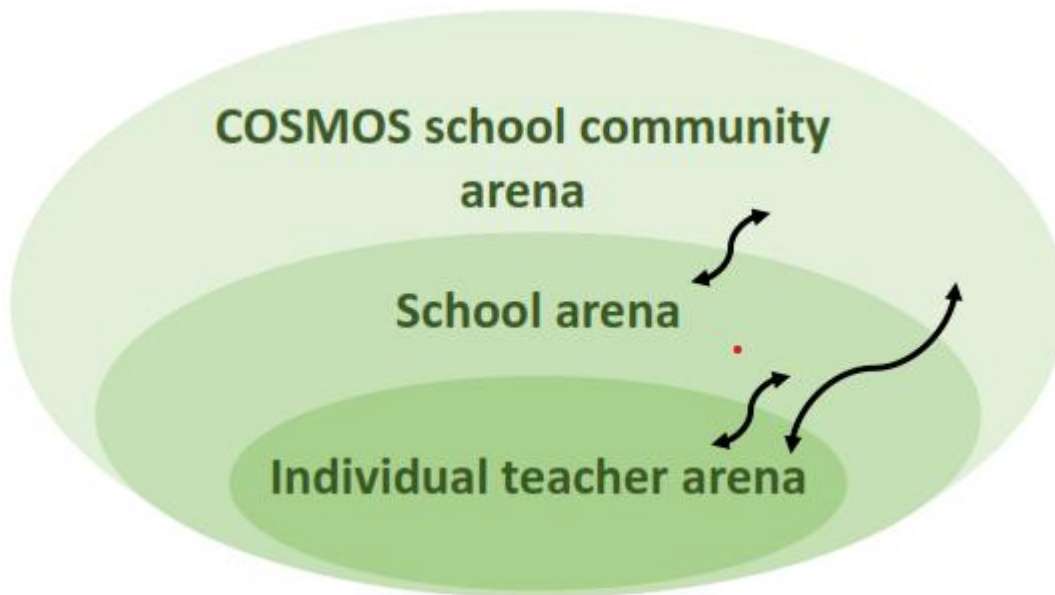


Figure 2. Three arenas for conducting TPD

When -

The timeframe, coordinated with the school year, provides a suggested **time range** for each conceptual stage of TPD. Within each time range, the number of sessions (meetings, workshops) conducted in each stage of TPD is flexible and based on the judgement of the country partner conducting WP3/4, taking into consideration factors such as the time each school team can invest in TPD, their TPD necessities (in relation to adapting the project to the school community and physical settings), movement along the openness continuum (from more inward to more outward mode), and coordination with WPs 3&4 actions.

TPD Timeframe

TPD content	Who	Month range
COSMOS approach: Developing open schooling "mindset" – learning in and as a community – why (benefits)	School teams (school arena). COSMOS school community	June/Sept 2022 – December 2022
Focus in SSIBL – <ul style="list-style-type: none"> Principles of the SSIBL model How to recruit community – establishing a CoP around selected SSI Developing learning unit/s in a CoP 	School teams, CoP Individual teachers. May include mutual learning among schools	Nov 2022 – May 2023
Reflection – conducting meaningful reflection, extracting insights	School teams. When included as a community of COSMOS schools, the school level precedes school community level	April -June 2023

The time frame of each conceptual stage is shown in the following Figure 3a, 3b, 3c & 3d.



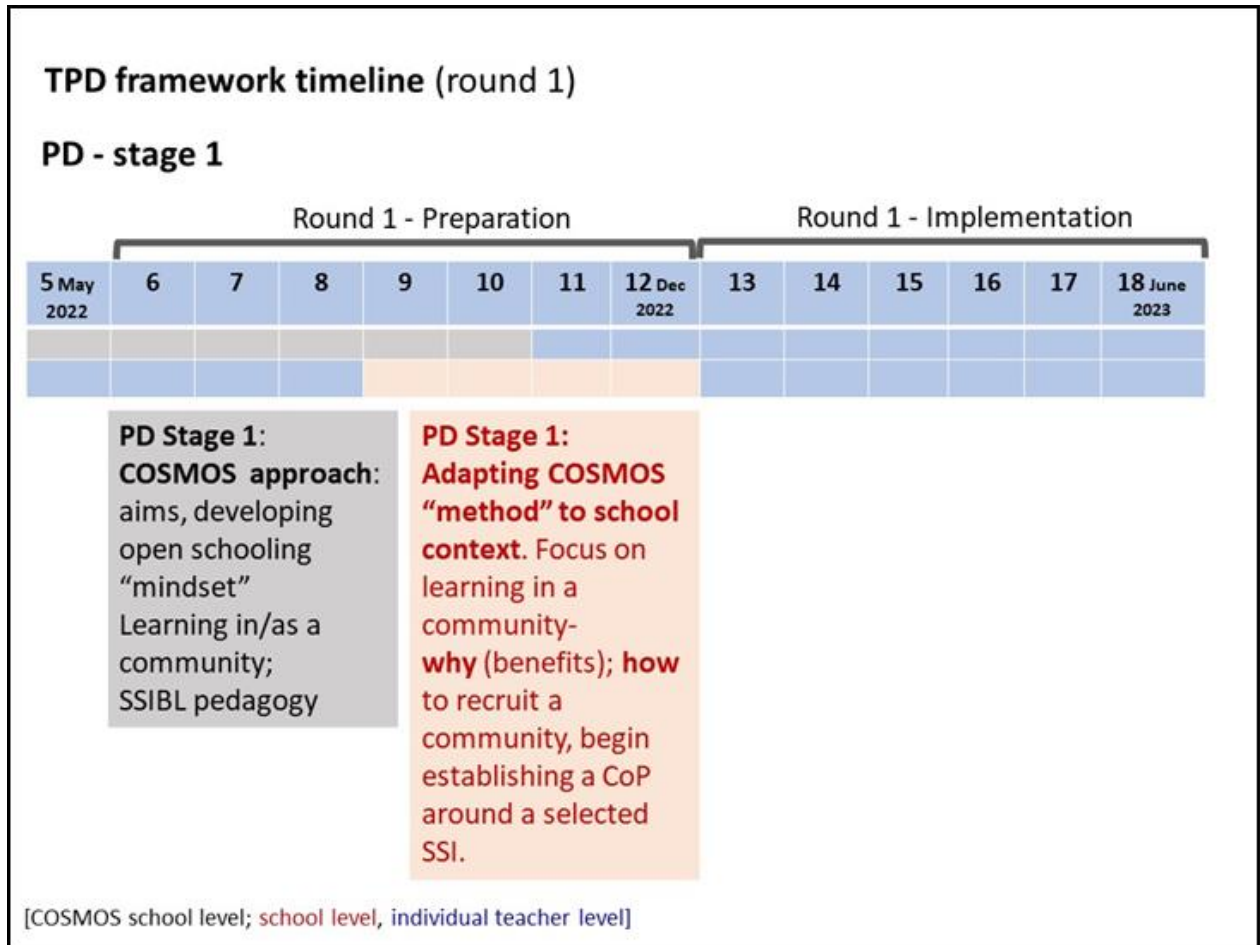


Figure 3a. Time range for conducting TPD stage 1 - The COSMOS method

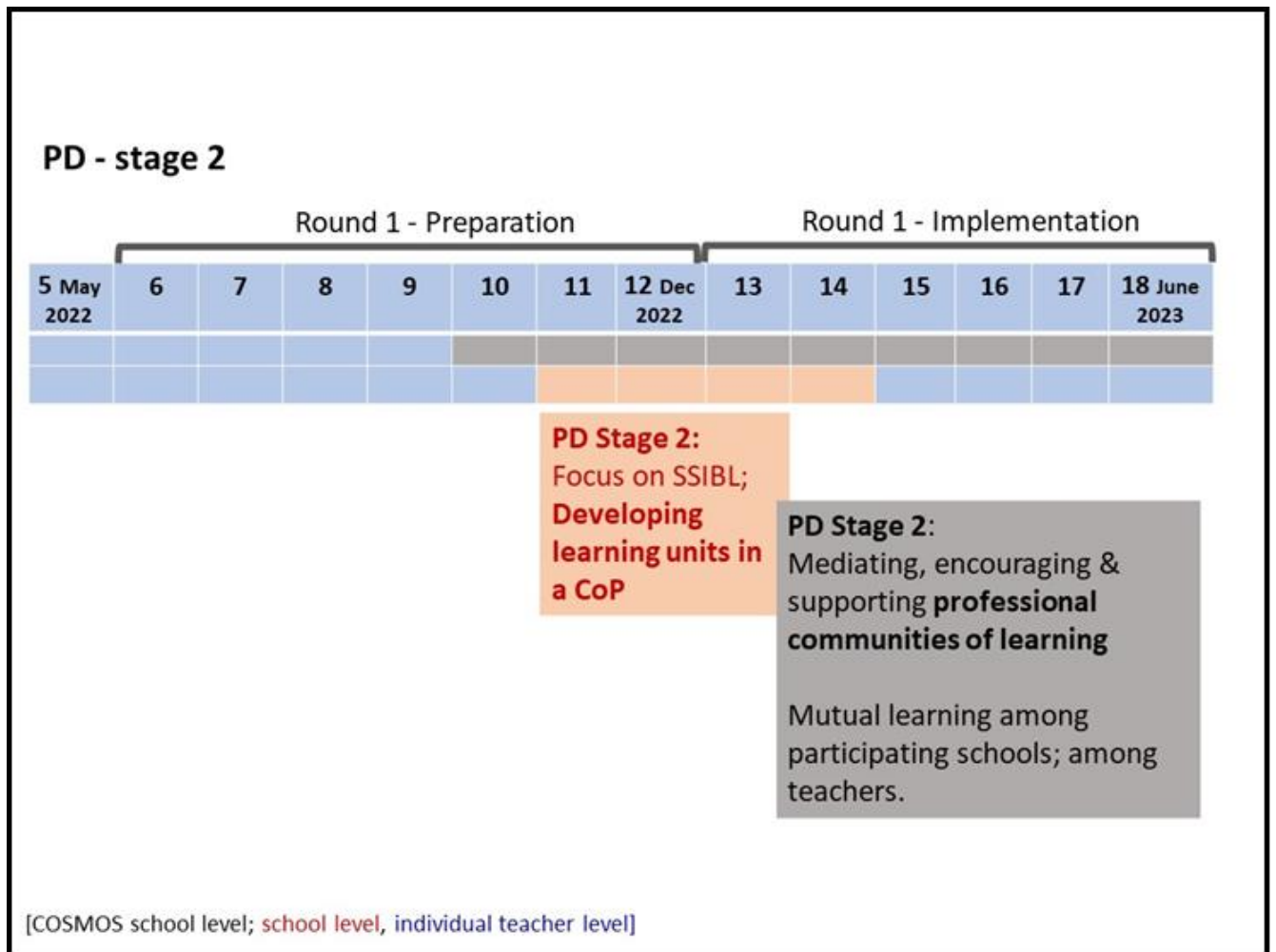


Figure 3b. Time range for conducting TPD stage 2- Community-oriented SSIBL (and designing and implementing the SSI learning unit)

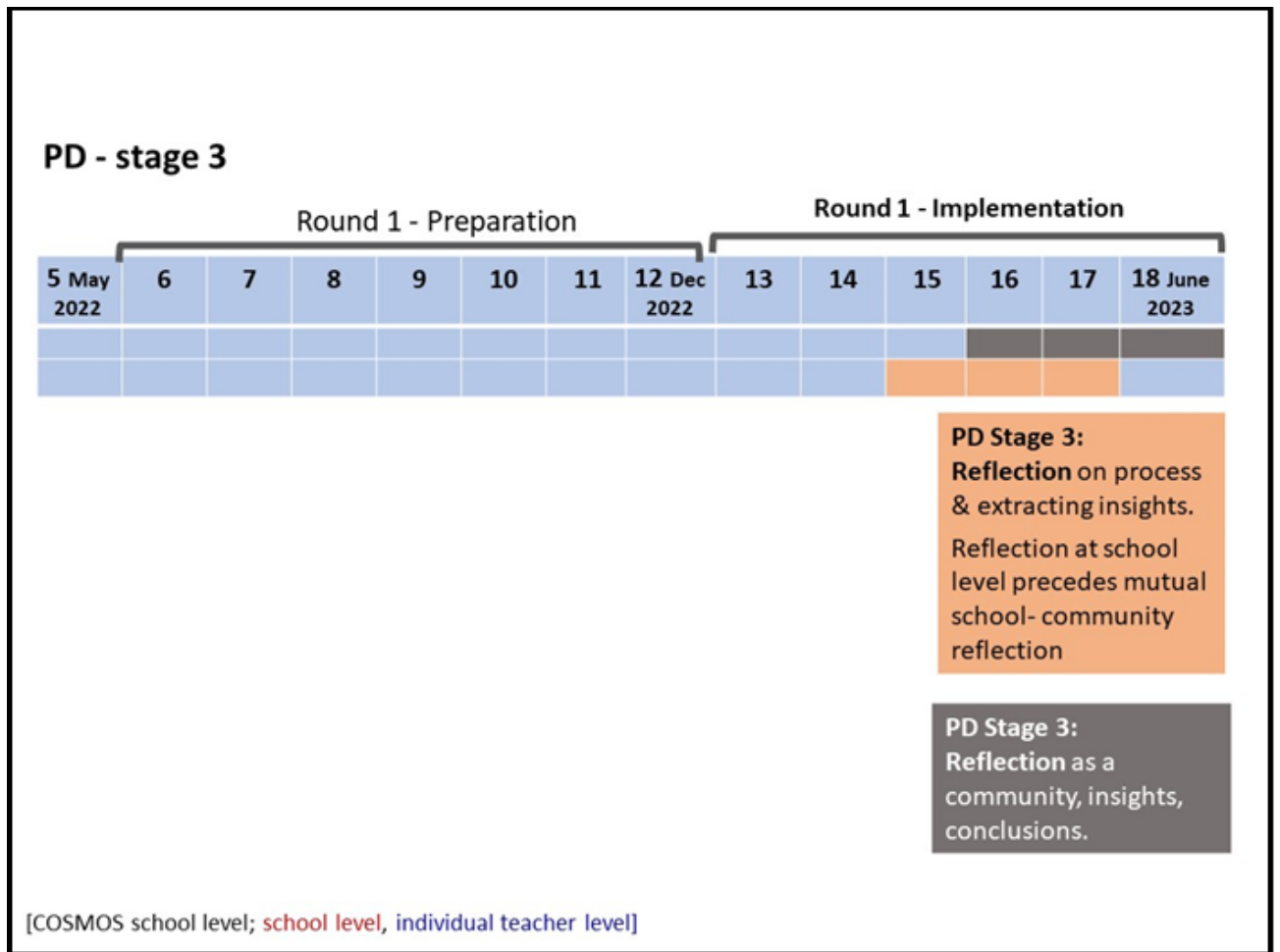


Figure 3c. Time range for conducting TPD stage 3 - Final Reflection

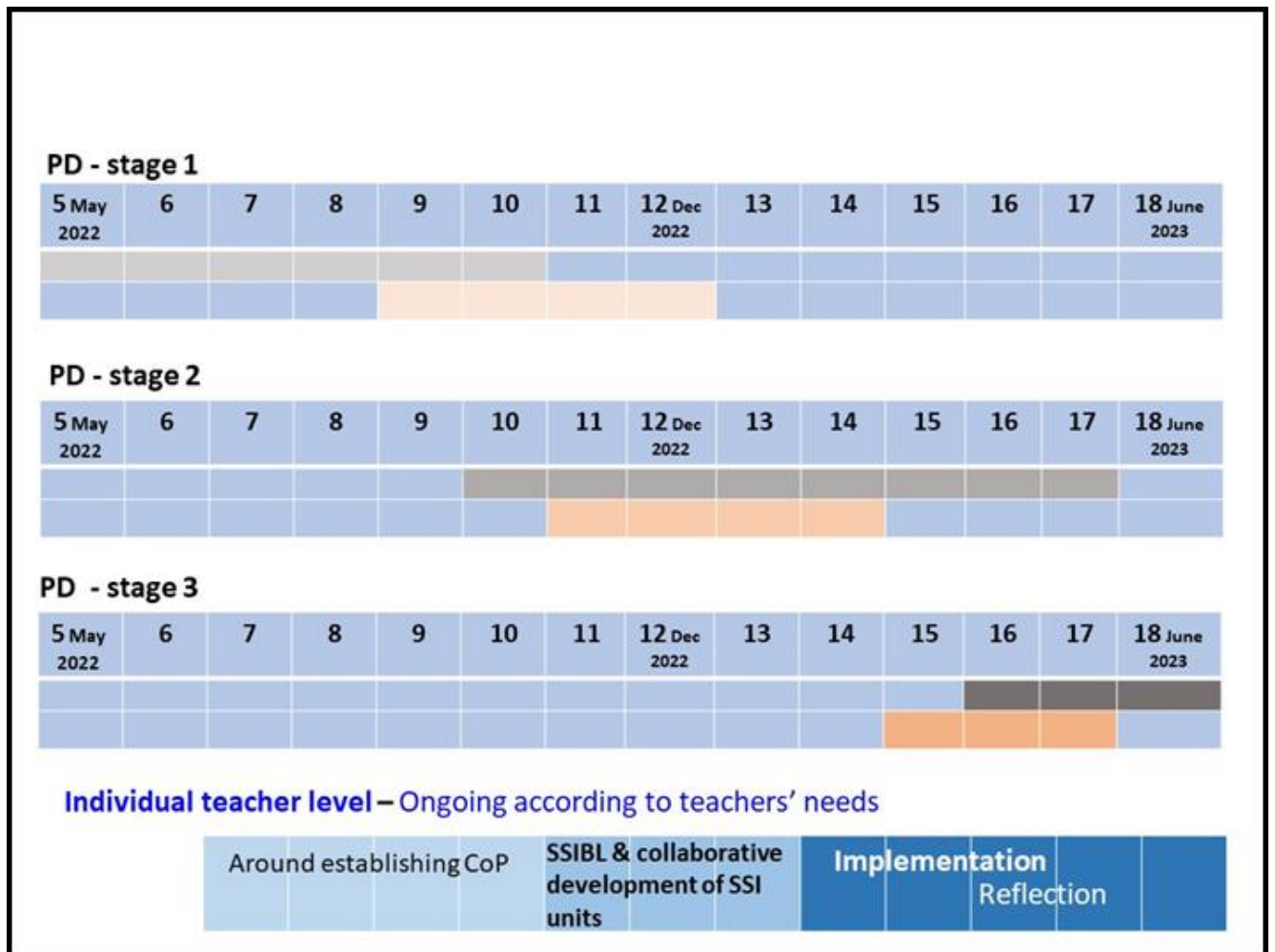


Figure 3d. Overview of the time ranges for the three TPD stages

Presenting COSMOS

Logo/s of [Academic & Societal partner] institutions



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

HORIZON2020 SWAF

Societal partner

Names

Academic Partner

Names



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101005982

“...Opening schools to the community via partnerships that cultivate science education that is relevant for all”



insert picture of child doing science in your country

Major challenges this project responds to:

- **Cultivating young people’s interest and curiosity in science fields** (now, further schooling, towards career – **in line with OECD goals**)
- **Developing global competencies including scientific literacy, environmental literacy, and responsible and involved citizens - **in line with OECD Education 2030****



“...Opening schools to the community via partnerships that cultivate science education that is relevant for all”

Project aims

1. Open school to the community – **change organizational culture**

outward

inward

2. **Promote meaningful science education** (relevant to learners' lives):

- Focus on **socio scientific issues** (SSI) relevant to community
- Implement **Socio-Scientific Inquiry-Based Learning** (SSIBL) pedagogy to achieve effective science teaching

Essence of the project



- COSMOS centers on developing and implementing collaborative learning processes with the community and as a community, in the area of science education.



- This will be achieved by supporting teachers and school teams in creating a **learning community** that collectively develops educational units on SSIs that are relevant to the school community and align with the science curriculum.



Core concepts of the project

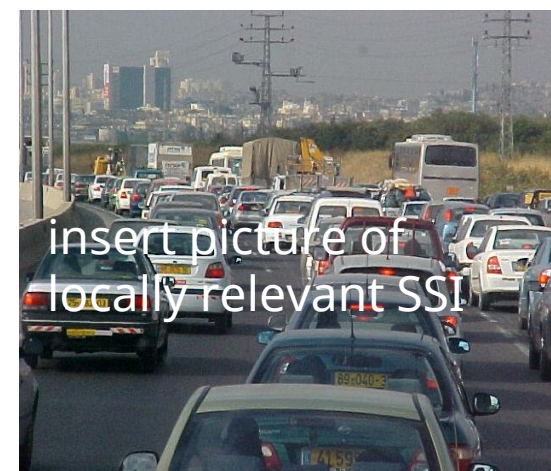


- **CORPOS** (Core Organizational Structure for Promoting Open Schooling) - **School body/team** whose role is to initiate and create school-community connections (open school up to the community).

- **CoP** (Community of Practice) - **learning community**
The community that is created around the local SSI selected as focus of learning.



- **SSI – Socio-Scientific Issue**
- **SSIBL** (Social Scientific Inquiry Based Learning)- The pedagogy employed in developing the learning units.



Project benefits for the school

PD and support of science teachers and other team partners in the project

Strengthening science studies
(relevance to students' lives)

Participation in international community of schools

Strengthening school-community connections around authentic SSIs

Strengthening students' voice and participation in learning processes

Strengthening students' learning skills

Professional Development stages

- **Three major steps**

Understand COSMOS “Method”

Learning in/as a
community
Create a CoP

- Why learn in a community
- Cultivate professional identity as open school
- Support creation of professional learning community
- Principles for recruiting a CoP around a SSI

SSIBL pedagogy

Theoretical
understanding and
collaborative
development of
learning unit around
chosen SSI

- SSIBL pedagogy – theoretical and practice
- Develop learning unit around local SSI based on SSIBL pedagogy & aligned with science curriculum.
- Implement the unit

Reflection on the process, insights

- [Significant] reflection on the process
- Extract insights (successes, challenges) regarding learning in a community, employing SSIBL as a pedagogy that enables meaningful science education.



This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement No 101005982



Levels of participation

The PD process may be conducted in 3 complementary arenas [levels] of participation

COSMOS school community level –
Teams from the community of schools (locally or internationally) in the project

School level –
Team (and CORPOS) of an individual school

Individual teacher level



Requirements of the participating schools

Participate in formative assessment processes conducted in the project

Take part in PD

Establish school leadership team (CORPOS)

Participate in local & international learning community

Develop & implement learning unit around chosen SSI employing

Establish learning community around SSI (teachers & community partners)

Timeline of COSMOS process

PD – Stage 1

Initiation

Implementation

5 May 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

School community -

Focus: Introducing COSMOS - Engaging the schools in COSMOS

School –

- Engaging the school in COSMOS (alternative to conducting in a community of schools)
- Adapting COSMOS to the school context
- TPD activities offered in the guidelines
- Establish CORPOS – discuss goals, responsibilities, how to select SSI
- Select SSI and build a CoP around the SSI.

PD – Stage 2

Initiation

Implementation

5 May 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

School community -

Support development of the participating schools and teachers as a professional learning community

School –

- Principles of SSIBL pedagogy
- Guiding and supporting school team (and CoP) in developing the SSI unit
- Guiding and supporting the school team (and CoP) in implementing the unit

PD – Stage 2

Round 1 - Implementation

May 5 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

Reflection

- WP7 assessment actions (focus groups, interviews, questionnaires)
- Reflection on the process
- Preparation towards Lisbon

Summarizing meeting with participating schools

- Reflecting as a community
- Sharing insights regarding the process
- Suggested: Rehearsal for Lisbon

PD - stage 1

5 May 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

PD - stage 2

5 May 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

PD - stage 3

5 May 2022	6	7	8	9	10	11	12 Dec 2022	13	14	15	16	17	18 June 2023

Individual support of teachers – throughout the process according to ad-hoc needs

Around establishing CoP	Around SSIBL and collaborative development of SSI unit	Support implementation	Reflection
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Logo/s of [Academic & Societal partner] institutions



Thanks for listening



ANY
QUESTIONS
?

COSMOS



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101005982

SSIBL pedagogy for TPD handbook round 1



Socio-Scientific Inquiry-Based Learning (SSIBL) within Communities of Practice

Acknowledgements:

This presentation is adapted from the SSIBL presentation prepared by Assoc. Prof. Andri Christodoulou and Prof. Marcus Grace, University of Southampton within the PARRISE project funded by the EC and presented in the framework of COSMOS

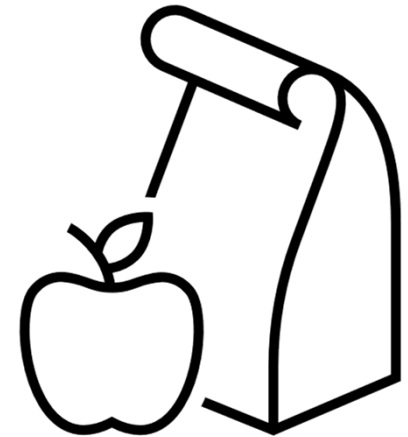


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Science with, for, and in Society

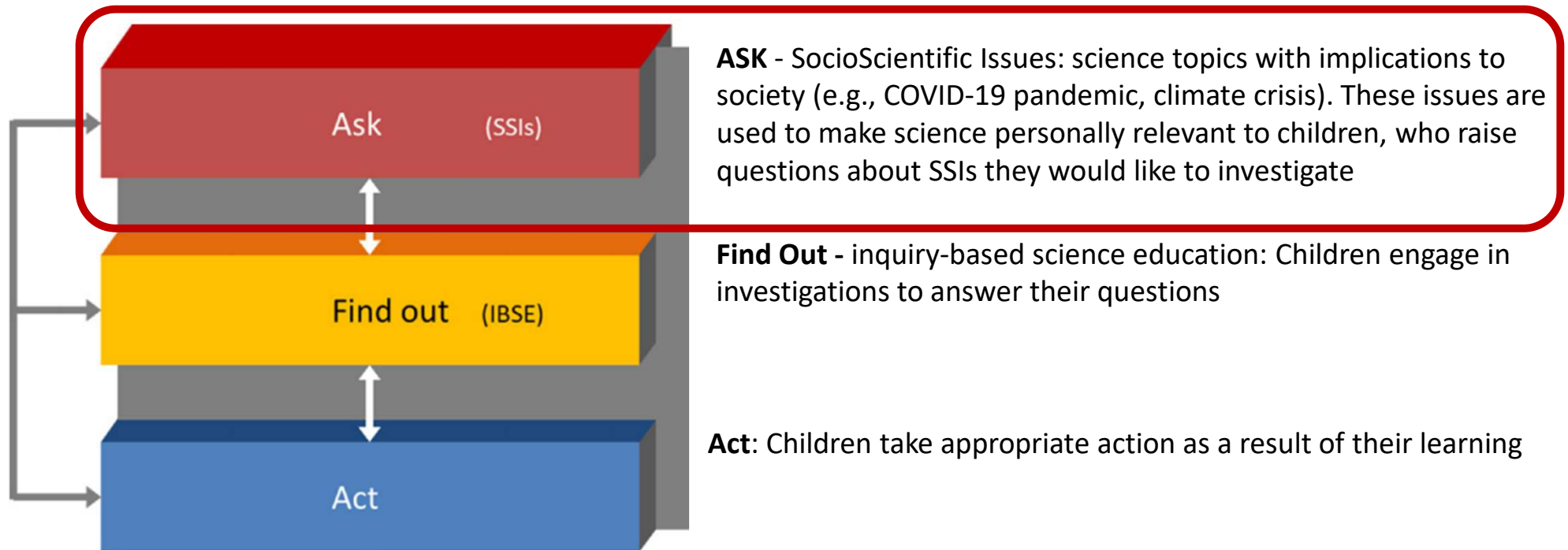
What issues of
relevance to both
Science and
Society can you
identify by
looking at these
pictures?

Can replace with other topics (e.g., from the media) as a point-of departure



- **What issues of relevance to both Science and Society can you identify by looking at these photos?**
 - Is there consensus on how these issues should be addressed/used/understood/communicated?
 - Is there a plurality of perspectives on how these issues can be addressed?
 - Are these issues perceived differently at local/national/global levels (e.g. within or across different community groups?)
- **As a community, how can we approach addressing these issues? What is of relevance to us and how can we unpack the different dimensions of these issues?**

Pedagogical model used in the COSMOS approach *Socio-Scientific inquiry-based learning (SSIBL)*



The SSIBL framework provides an approach to teaching science using socioscientific issues and inquiry-based learning as means towards promoting/developing citizenship competencies. This simplified pedagogical model can be used in teacher education and in classroom-based teaching.

You can find out more about SSIBL here: <https://www.parrise.eu/>

1. ASK

What are socio-scientific issues? (SSIs)

SSIs are issues with a basis in science and a potentially large impact on society (Ratcliffe & Grace, 2003)

- Science aspects (often ‘science-in-the-making’)
- Societal aspects (economic, political, cultural)
- Emotions (personal views)
- Values (ethical, moral, cultural)

What characterises socio-scientific Issues?

plurality of views/arguments/interests / possible explanations

controversial in nature – present a dilemma

uncertainty – a definitive answer does not always exist

**based on scientific evidence with applications of societal importance
Involve values**

personal relevance and links to everyday life

personal, local, national and global dimensions & action

raise issues of ‘trust’ (e.g., science in the media & misinformation)

(Ratcliffe & Grace, 2003; Sadler, 2009)

Examples of socioscientific issues

Global

- climate change
- Deforestation
- Loss of biodiversity
- Whaling / Overfishing
- COVID / pandemics
- Add issues; have teachers contribute issues

Non-socioscientific issues

- Housing
- Immigration issues
- Parents' rights over choice of schools
- Religious issues
- Have teachers suggest non socioscientific issues and discuss why they are non SSI

National

- COVID vaccinations
- Electric cars
- Transportation – public versus individual
- Add issues that are relevant to your country; have teachers contribute issues

Local

- Recycling / Reducing consumerism
- New housing developments – urban development
- Pedestrianising streets in a school's surrounding area
- Loss of green spaces and wildlife
- Add issues that are relevant to your area; have teachers contribute issues

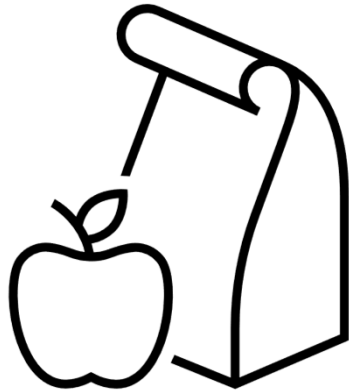
Context is important in deciding what is a SSI. For example, housing, immigration issues or religious issues can be SSI in certain conditions



**Meaningful
to students**

**Insert/replace with pictures
that are relevant for your
audience – at national and
local levels**

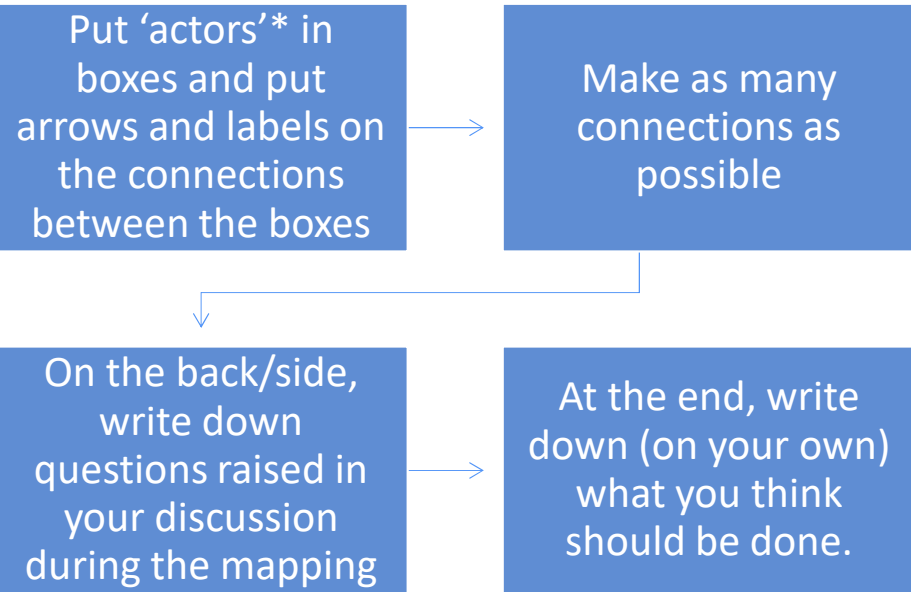




Thinking further about our lunch...

Choose one issue you have identified in your group

In your group consider 'what should be done about the issue, what are the possible solutions...'



*'actors' or stakeholders in the controversy are both human (e.g. consumers) and non-human (e.g. concepts such as animal welfare, fairtrade)

Some prompt questions to support the map construction

What is the nature of the controversy? (the focus of the issue, available evidence, values, interest positions, priorities)

Who are the main stakeholders? Which individuals, campaigning groups or local/ national/ international organisations (governmental and NGO) are prominent players?

Who are the affected parties? Who or what stands to gain or lose by the outcome of the controversy?

What are the personal, social, local, global, present and future dimensions of the issue?

What types of knowledge are involved and needed?

This is supplementary: A suggested component that helps identify stakeholders' positions.

ETHICAL MATRIX (MEPHAM)

A tool for analysing stakeholders' positioning for a SSI and a starting point for asking investigation questions

Respect for:	Wellbeing	Autonomy	Justice	...
Stakeholders				

Mepham, M. (2000). A Framework for the Ethical Analysis of Novel Foods: The Ethical Matrix. *Journal of Agricultural and Environmental Ethics*, 12(2), 165–176.

Analysing controversies: Ethical Matrix of Mepham (Knippels & van Harskamp, 2018, p.49):

Mepham's (2005) ethical matrix can help to clarify different values and compares the views of various stakeholders in the dilemma through three main ethical principles, namely autonomy, well-being and fairness.

Table 1 Example of an ethical matrix for the 'Oostvaardersplassen' issue, mapping the views of various stakeholders in the dilemma against three main ethical principles

Replace with a matrix around a locally relevant issue

Stakeholders	Respect for:		
	Well-being	Autonomy	Fairness
Visitors to the park	Pleasant visit to the national park	Able to enjoy the national park in their own way	Assure affordability to visit the national park
Animals	Enough food to live	Are able to migrate to areas with enough food	Sustainability of population, intrinsic value
Forestry Service	Feel successful in and capable of performing their job in the available time	Able to perform their job in the way they prefer	Ensure natural ecosystem equilibrium
NGOs	Animal rights laws respected	Able to act on their values and beliefs and fulfil their professional mission	Duty of care



Your questions about the controversy

Look at the questions you have listed about what you don't know, or what you'd like to know more about, in relation to your chosen SSI

Can you (re)formulate one of these questions into an investigation question?

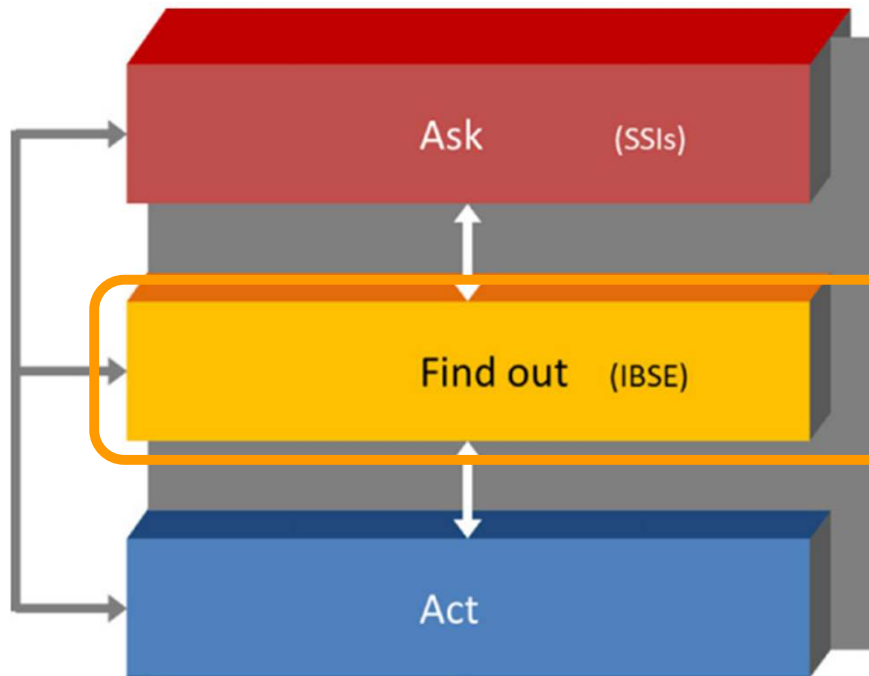
- How can you go about answering these questions?
- What types of inquiries would you design?
- What types of knowledge & skills would be needed to conduct this investigation?

Selecting, mapping and extracting questions as a **community of practice**

Some prompt questions:

- How does identifying SSIs as a CoP differ from that when conducted as an individual teacher?
- How does it benefit: the mapping of stakeholders? Understanding their positions? Enriching and deepening the understanding of the controversies involved in the SSI? Enriching the inquiry questions concerning the SSI?
- What are the challenges envisioned in conducting this as a CoP?

Pedagogical model used in the COSMOS approach *Socio-Scientific inquiry-based learning (SSIBL)**



ASK - SocioScientific Issues: science topics with implications to society (e.g., COVID-19 pandemic, climate crisis). These issues are used to make science personally relevant to children, who raise questions about SSIs they would like to investigate.

Find Out - inquiry-based science education: Children engage in investigations to answer their questions

Act: Children take appropriate action as a result of their learning

*Levinson, R., Knippels, M.C., van Dam, F., Kyza, E. *et al.* (2017). *Science and society in education*. Socio-Scientific Inquiry-Based Learning: connecting formal and informal science education with society. (<https://www.parrise.eu/wp-content/uploads/2018/03/parrise-en-rgb.pdf>)

*You can find out more about SSIBL here: <https://www.parrise.eu/>

2. FIND OUT

What is inquiry-based learning?

...it is the design, implementation, analysis and evaluation of a scientific investigation that is:

- **Question-driven:** students have posed a scientific question they wish to investigate
- **Open-ended:** there are various ways of approaching the investigation
- **Authentic** – models ‘real science’, requires student *ownership* and *relevance*

Types of inquiry within SSIBL

- **Scientific** – content knowledge
- **Personal** – own values and beliefs (self-knowledge)
- **Societal** – motives and strategies of influential stakeholders, social values, and implications for society (societal knowledge)

(based on: Waarlo, 2014; Knippels & van Harskamp, 2018)

Inquiry in SSIBL can be social – e.g. finding out what people think, their positions, interests, values and views

Science Inquiry in your context...

- 1. What is inquiry? Individually, provide up to three words or short phrases to describe 'inquiry'**
- 2. What types of 'inquiry' have you used, are aware of or have seen happening in your context?**
- 3. How is it different to 'normal' (conventional) science teaching?**

Types of Scientific Inquiry



Surveys and correlations (pattern seeking)



Using secondary sources



Controlling variables (fair testing)



Identification and classification



Using and evaluating a technique



Using experimental models and analogies to explore an explanation, hypothesis or theory

Department for Education, England (2002); Taken from the KSE National Strategy for Scientific Inquiry, from 2002, in England

THE MANY LEVELS OF Inquiry

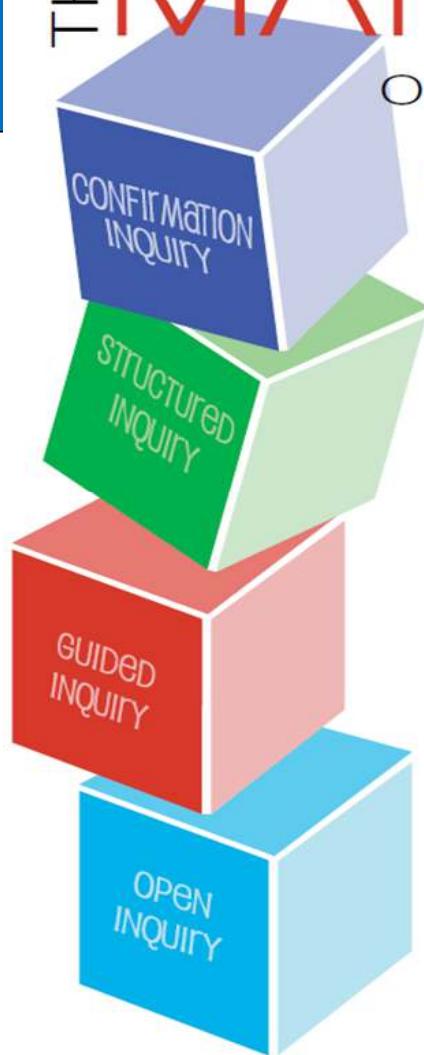


Figure 1.

The four levels of inquiry and the information given to the student in each one.

Inquiry Level	Question	Procedure	Solution
1—Confirmation Inquiry <i>Students confirm a principle through an activity when the results are known in advance.</i>	✓	✓	✓
2—Structured Inquiry <i>Students investigate a teacher-presented question through a prescribed procedure.</i>	✓	✓	
3—Guided Inquiry <i>Students investigate a teacher-presented question using student designed/selected procedures.</i>	✓		
4—Open Inquiry <i>Students investigate questions that are student formulated through student designed/selected procedures.</i>			

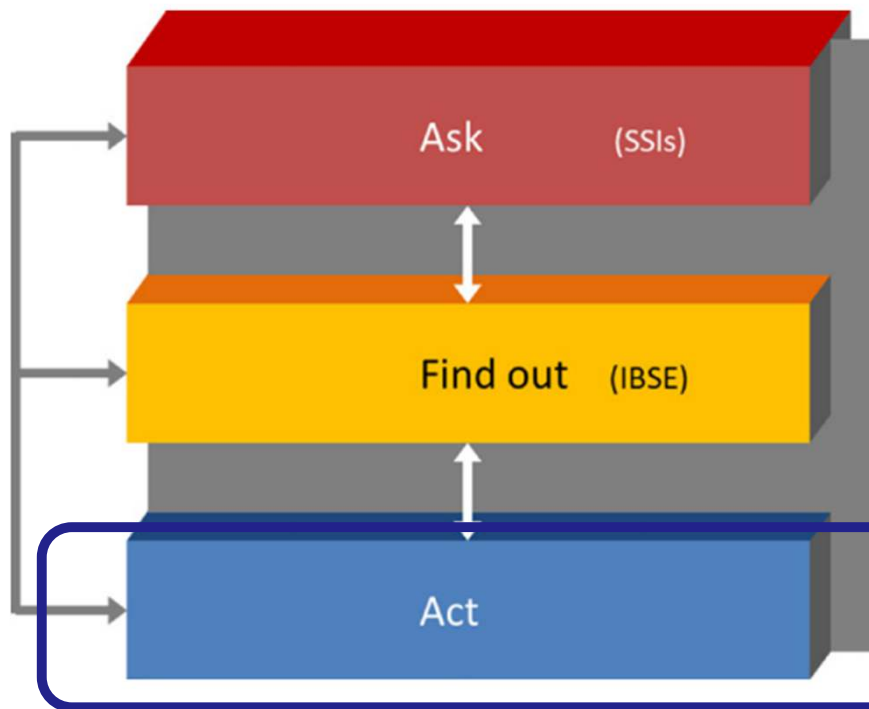
Banchi, H., & Bell, R. (2008). The many levels of inquiry. *Science and children*, 46(2), 26.

Socially-responsible inquiry within Communities of Practice

Some prompt questions:

- How does identifying SSIs as a CoP influence inquiry-based learning? How can socially-responsible inquiries be designed and implemented as a community of practice?
- How does conducting the inquiry of a SSI as a CoP influence the inquiry-based learning?
- How can socially-responsible inquiry benefit the CoP?
- What are the challenges envisioned?

Pedagogical model used in the COSMOS approach *Socio-Scientific inquiry-based learning (SSIBL)*



ASK - SocioScientific Issues: science topics with implications to society (e.g., COVID-19 pandemic, climate crisis). These issues are used to make science personally relevant to children, who raise questions about SSIs they would like to investigate.

Find Out - inquiry-based science education: Children engage in investigations to answer their questions

Act: Children formulate and take appropriate action as a result of their learning that helps to enact change

You can find out more about SSIBL here: <https://www.parrise.eu/>

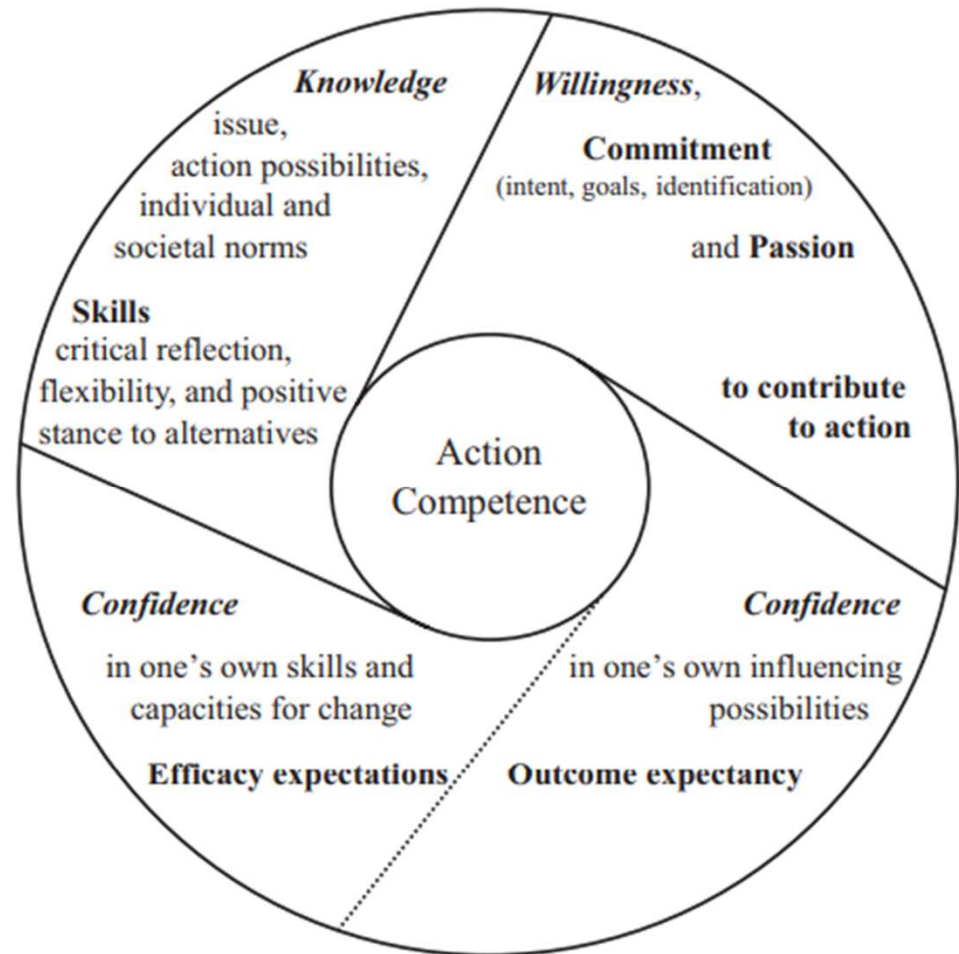
Taking Action

- ✓ **How can we create opportunities for students to take action as a result of their investigations?**
 - ✓ **Developing a plan** for addressing the issue
 - ✓ **Making something** (e.g., healthy drinks, a school vegetable plot, a butterfly garden, a poster encouraging fellow students to walk to school rather than drive a pamphlet suggesting ways to address the issue);
 - ✓ **Writing to an MP or public representative;**
 - ✓ **Generating a petition;**
 - ✓ **Providing information**, such as you tube clips or pamphlets, to support improving personal actions (e.g., avoiding disposal of plastic cups); providing services (e.g., recycling mobile phones).

Taking Action

- What is the role of the teacher in this process?
- How are action competencies incorporated into SSIBL-CoP implementations so that they become sustainable?

Action competences framework (Sass et al., p.298)



Sass, W., Boeve-de Pauw, J., Olsson, D., Gericke, N., De Maeyer, S., & Van Petegem, P. (2020). Redefining action competence: The case of sustainable development. *The Journal of Environmental Education*, 51(4), 292-305, <https://doi.org/10.1080/00958964.2020.1765132>

Taking Action in teachers' SSIBL lesson designs and implementation



Amos, R., & Christodoulou, A. (2018). Really working scientifically: strategies for engaging students with socio-scientific inquiry-based learning (SSIBL). *School Science Review*, 100(371), 59-65

Ariza, M. R., Christodoulou, A., Harskamp, M. V., Knippels, M. C. P., Kyza, E. A., Levinson, R., & Agesilaou, A. (2021). Socio-Scientific Inquiry-Based Learning as a Means toward Environmental Citizenship. *Sustainability*, 13(20), 11509.

How does conducting SSIBL within a CoP influence taking action

- **Let's go back and consider the benefits of mapping a SSI within a CoP**

Points for thought:

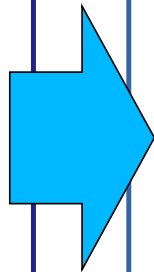
Diversity and richness of perspectives

Depth of understanding stakeholders' positions

Understanding of the controversies around the issue

Diversity of inquiry questions, Significance & relevance of inquiry questions

More ideas?



- **How do these benefits (framing SSI within a Community) effect the inquiry (ASK)?**

Points for thought:

Content – breadth, depth

Different knowledges

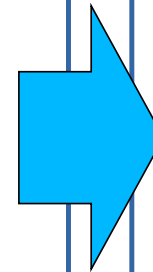
Sources of information

Sources of experts

Methods of inquiry

Designing the inquiry

More ideas?



- **How does enriched inquiry effect action-taking?**

Points for thought:

Types of possible action

To whom or what is action directed

Socially-sensitive and responsible action

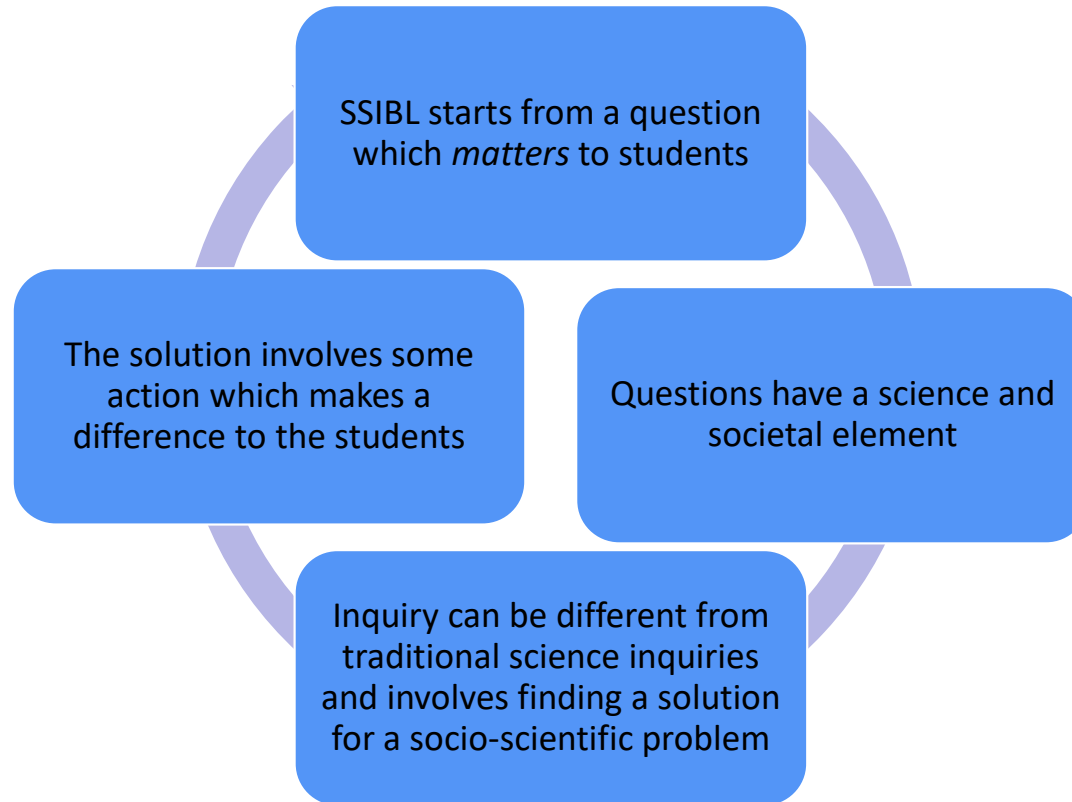
Effectiveness of action to promoting change

Sustainability of action –

Environmentally-responsible action, in line with SD goals

More ideas?

So what is SSIBL?



Enriching your foundations concerning SSIBL – some supplementary slides

Learning/Teaching Strategies for SSIBL

Small group discussion/Whole class debate

Role Play/simulations

Consequence mapping (using 'what if' questions)

Heads and hearts (rational decisions v emotional decisions)

Evaluating media reports (and writing their own)

Probability and Risk (how risk statistics are derived, etc)

Decision-making frameworks (What should be done? why and how?)

Rights v responsibilities

Story-telling

Mapping controversies

Using real case studies

Using visiting 'experts'

Grace, M. (2010) Science for Citizenship, In: Frost, J. (ed.) Learning to Teach Science in the Secondary School (3rd Edition), pp 218-232. London: Routledge

SSIs are complex and controversial issues

...so **do we need to teach more facts about them...?**

“the best way to engage students and the public with SSIs is **NOT** by giving them more facts but rather engage them in dialogue and fostering critical engagement”

(Baram-Tsabari & Osborne, 2015)

Designing and carrying out Socially-Responsible Inquiries

When planning SSIBL activities consider how you might:

- Stimulate students to ask their own authentic questions (what resources/devices might you use?)
- Support students in deciding how to do research
- What preparation would you (trainer or teacher) need to do?
- How would you integrate it with the science curriculum?
- Are there cross-curricular possibilities?
- How could you incorporate aspects of 'taking action' as a result of the lesson/unit?
- What are the challenges you think *you* would face?

SSIBL discussion points

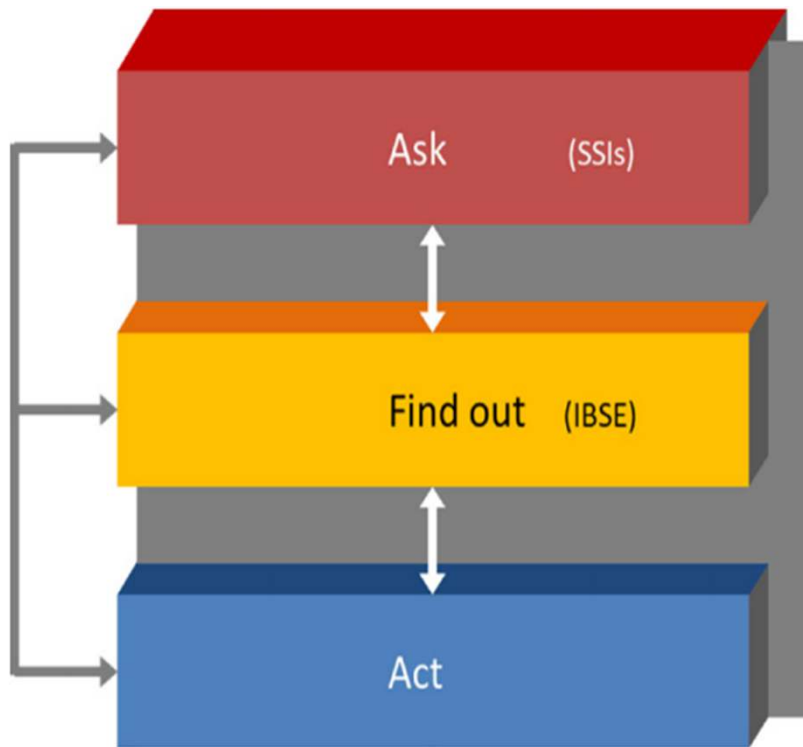
A SSIBL unit could have a longer term structure (e.g., based on longitudinal studies) or short units e.g., 2-3 lessons). In either case, the key dimensions of 'authentic questions' (ASK), doing socially responsible inquiries (FIND OUT) and taking action (ACT) should be addressed.

However to be able to address these dimensions you might want to start introducing them, and the skills needed, gradually - e.g., how do we encourage children to ask personally relevant questions, and questions that can then become investigation questions? What types of inquiry are the children used to? What other types can be introduced to the curriculum?

Teachers' views and concerns about addressing controversial issues

- **NO TIME** for social and ethical issues
- **VALUES** should not be part of the science curriculum - teaching scientific concepts and processes is the main priority
- **LACK OF CONFIDENCE** in handling issues with no 'right' answers
- Concerns about **STUDENT BEHAVIOUR**
- Lack of good **TEACHING RESOURCES**
- **LACK OF KNOWLEDGE** about teaching strategies
- **POSSIBLE ACCUSATIONS OF BIAS**
- Hesitance to engage in debates regarding issues that are at odds with the interests of some of the stakeholders or underlying power structures in their community since centralized educational systems do not exist in a political vacuum

Example of SSIBL around wildlife protection



WILDLIFE PROTECTION

ASK: How can we make our school one of the most wildlife friendly places in [**name relevant place in your country**]?

Find out:

What's here already?

(e.g., children take photographs, hedgehog footprint tunnels, animal footprints, pitfall traps, night camera) [**add activities for collecting in-situ evidence of the existing wildlife in the selected place**]

How can we attract more wildlife?

Wildlife survey: (ideas - wildflower seeds, bird feeders, etc)

People survey: ask children/parents/local people

Act:

Children take appropriate action as a result of their learning (e.g., make or buy nest boxes, bug hotels, make hedgehog holes in fences, and **communicate** activities with local people)

Some contexts that could be used as socioscientific issues in **[your country]**

Example contexts are provided in the following slides **[create a few slides that provide examples of some debates around locally or nationally relevant SSIs with excerpts from the media]**

Have you heard about how the world's getting hotter? Some people say it is. Some say it isn't. Who's right? And does it matter? How will it affect you and your friends? How will it affect penguins? What can we do about it? These are some of the things I wanted to find out about.



It's not really happening, is it?

- ...we know (?) that the planet is getting warmer
- Who's causing climate change?

Climate change

TURN IDEAS INTO ACTION!

Often we hear people complain about the weather – particularly if it is raining and they have forgotten their umbrella! But being outside in all types of weather is a great way to connect with nature. It's also fantastic for our mental health!

Once a day, go outside and take a moment to notice what the weather is like. Close your eyes and focus on what it feels like to be outside in nature. Do you feel cold or warm? Can you feel any breeze on your skin? How does the weather today make you feel?



Examples of Socially-Responsible Inquiry questions raised by students

Should schools charge more money for “unhealthy” foods?

Why do only three students in my class cycle / walk to school?

How can the number of plastic bottles being used in my school be reduced?

How can we become more healthy?

Does recycling do more harm than good?

Should animal organs be used for humans?

What are the impacts of an increasing global population?

How can we reduce air pollution?.

How can the school reduce the amount of electricity used?

Other examples focusing on the environment could be the following:

- Pollution (asbestos, contaminated land, industrial pollution, air pollution, street cleaning)
- Animal Welfare
- Recycling / Reducing consumerism
- Energy efficiency
- Water accessibility/quality
- **Add more locally and globally-relevant environmental issues**