CONNECT

Inclusive open schooling with engaging and future-oriented science

D4.3

A set of SCIENCE ACTION resources for informal education v1

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www.connect-science.net

This project has received funding from the European Union's Horizon 2020 Research ad Innovation Programme under Grant Agreement No 872814

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Peer Reviews

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Revision History

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Executive summary

The CONNECT project aims at increasing students' scientific confidence by giving them an experience of "*science is for me*" through an open schooling approach. The Open-ended Scenarios sets out to trigger students' interest in STEM by aligning science education with societal needs and values through the adaptation of participatory methods to open-schooling processes. This second Open-ended Scenario – the Consensus format open-ended scenario is a restructuring of the participatory approach, the consensus conference. In six step the students will go through a process of finding a local challenge they find interesting, conducting research, consult with experts as well as formulate and disseminate recommendations encouraging local decision-makers to act on the challenge. This deliverable provides an overview of the Consensus Format Open-ended Scenario, including materials for teachers, students, families, and experts.

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1. Introduction

The CONNECT project aims at increasing students' scientific confidence by giving them an experience of "*science is for me*" through an open schooling approach. This approach operates with two types of scenarios, the structured and the open-ended.

The Open-ended Scenarios sets out to trigger students' interest in STEM by aligning science education with societal needs and values through the adaptation of participatory methods to open-schooling processes.

To do so an Open-ended Scenario Framework has been built upon the Danish Board of Technology Foundation's many years of experience with deliberative democracy, technology assessment and Responsible research & innovation (RRI). The framework hereby takes a point of departure in the idea that societal needs and values should set the agenda for research and innovation by putting scientific knowledge into the context of society as well as using this knowledge for decision-making processes[1].

The framework contains six steps, two for each of the CONNECT Science Action stages – CARE, KNOW, DO. Each step has different options for methods and participants. Based on this framework, an Open-ended Scenario Pilot has been developed with one combination of methods and participants in each step.

Based on the feedback given by the consortium as well as by the CONNECT User Advisory Board a new Open-ended Scenario has been developed – the Consensus Format Open-ended Scenario. It takes a point of departure in the Consensus Conference, a participatory method setting out to reach consensus on controversial and conflict-ridden challenges faced by society, as well as to put the challenges on the political agenda by formulating well-informed and knowledge-based recommendations.

This deliverable provides an overview of the Consensus Format Open-ended Scenario, including materials for teachers, students, families, and experts.

1.1 Updated version of the Open-ended Scenario Framework

The Open-ended Scenario Framework has been updated according to the experiences and feedback received through the pilot period. Infographics by LOBA.

Although different participants are listed under all steps of the framework, the students should always be deciding on the challenge they will be work with (in the *Framing* step) as well as formulate the recommendations (in the *Recommendations* step). The different participants can support the students in these two steps, but the students should make the final decision.

[1] The Danish Board of Technology Foundation, https://tekno.dk/focus_area/responsible-research-innovation/?lang=en

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Figure 1 Open-ended Scenario Framework, small infographic

CONNECT
Students & scientists solving real-problems

OPEN – ENDED SCENARIO FRAMEWORK

SCIENCE ACTION STAGES	WE care		WE know		WE do	
STEPS	Framing	Questions	Knowledge & opinions	Deliberation	Recommendations	Dissemination
METHODS	• Define agenda • Set up tasks • Guidelines	• Search & dialogue	• Desk-top • Interviews • Stakeholder analysis • Panels	• Jury format • Consensus format • Co-creation	• Knowledge -based • Well-informed	• Open letter with recommendations • Article • Presentation
PARTICIPANTS	• Experts • Stakeholders • Families		• Experts • Stakeholders • Families	• Fellow students • Experts • Stakeholders • Families	• Experts • Stakeholders • Families	• Decision -makers • Media • Stakeholders • Families
LEARNING OBJECTIVES	To **discuss and trigger students' interest** in community-based and socio-scientific issues		To **acquire scientific understanding** of local issues supported by scientists To **collaboratively develop** alternative solutions		To **communicate science** projects to the local community To contribute to **local decision making** processes	

1.2 Feedback on Open-ended Scenario Pilot

Implementing partners have been providing feedback on the Open-ended Scenario Pilot continuously, through internal workshops and meetings. The Open-ended Scenario Pilot was moreover discussed at the first User Advisory Board (UAB) meeting in February 2021.

The feedback has been positive. The open approach was regarded as very interesting and much needed. It was highlighted that it is important to trust the students to take the task seriously and come up with relevant challenges to work with. This is however easier said than done and the open approach of the pilot can also be challenging to work with in practice. Particularly, in Greece it has been a challenge to implement this approach to informal learning.

This was also the observation made by the UAB. It was highlighted that it is important to support the schools, teachers, and coaches in implementing and facilitating the Open-ended Scenario as well as helping them adjust the process to their needs and resources.

It was suggested to include research in the first step of the process (*Framing*), highlight the scientific approach in the KNOW-phase (*Knowledge and opinions*, and *Deliberation*) as well as to include the families in more steps. Information materials for the families as well as good examples of implementation for the schools was moreover suggested as useful tools for implementing schools.

The feedback on the pilot has been taken into consideration in the development of the Consensus Format Open-ended Scenario.

Read more about the first CONNECT User Advisory Board meeting here.

2. Consensus Format Open-ended Scenario

This second open-ended scenario builds upon the same six steps of the Open-ended Scenario Framework as the pilot. Each step is however different in terms of content and participants as they are structured around the Consensus Conference method, whereas the pilot was primarily inspired by the Citizen Jury method.

In the pilot agreements is reached through voting and prioritizing throughout the process. In the Consensus Format Open-ended Scenario, the aim is to continuously reach consensus among the students throughout the process, particularly on the final recommendations. The involvement of experts and families also differs in the two types of open-ended scenarios. One of the main differences is that an expert will be included in the first step *Framing,* one feedback point by the implementing partners. The tables below provide an overview of the differences between the Open-ended Scenario Pilot and the Consensus Format Open-ended Scenario:

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Open-ended Scenario Pilot process:

	Steps	Methods	Participants
Care	**Framing**	Define agenda	*Families*
Care	**Questions**	Search and dialogue	*Students*
Know	**Knowledge & opinions**	*Desk-top, Interviews, Stakeholder analysis*	*Students*
Know	**Deliberation**	*Jury format*	*Experts*
Do	**Recommendations**	Knowledge-based, well-informed	*Students*
Do	**Dissemination**	*Open letter with recommendations*	Decision-makers, media, stakeholders

Figure 3 Open-ended Scenario Pilot process

Consensus Format Open-ended Scenario process:

	Steps	Methods	Participants
Care	**Framing**	Define agenda	*Experts* *Families*
Care	**Questions**	Search and dialogue	*Families*
Know	**Knowledge & opinions**	*Expert panel*	*Experts*
Know	**Deliberation**	*Consensus format*	*Families*
Do	**Recommendations**	Knowledge-based, well-informed	*Families*
Do	**Dissemination**	*Presentation of recommendations*	Decision-makers, media, stakeholders

Figure 4 Consensus Format Open-ended Scenario process

2.1 Consensus Conference

The Consensus Format Open-ended Scenario is structured after the participatory method named Consensus Conference.

The Consensus Conference is a process where a sociodemographic representative (in terms of gender, age, ethnicity, level of education and income) panel of 12-30 citizens discuss a socially controversial topic and provide input for decision making processes. The method has throughout the years been used to formulate well-informed and knowledge-based recommendations on controversial topics such as Gene Therapy (1995)[2], Biomonitoring (2006)[3] and the Ocean (2020)[4].

To prepare for the consensus conference the citizen panel will meet over two weekends. During these weekends, the panel will receive general information on the overall, already set topic that they will be working with. The panel is moreover encouraged to do their own research between the first and the second weekend.

[2] Engage2020 Action Catalogue "*Consensus Conference":* http://actioncatalogue.eu/method/7413

[3] Engage2020 Action Catalogue "*Consensus Conference":* http://actioncatalogue.eu/method/7413

[4] Vores hav "*Konsensuskonference*": https://voreshav.dk/hvordan/

Based on this information the panel will discuss different challenges linked to the overall topic and decide on an agenda for the conference as well as formulate questions for the expert panel. They moreover have the option to decide on experts or types of experts they would like to have included in the expert panel.

On the first day of the conference the expert panel present their responses to the citizen panel's questions. The expert panel consist of people with relevant knowledge on the challenge on the agenda. It can be scientist and researchers, but it can also be other stakeholders, such as representatives from civil society organisations, government, and industry. It is important that the expert panel represents different perspectives and opinions, across scientific disciplines and interests. These perspectives and opinions presented should of course be well reasoned and context relevant, but they can originate from different types of knowledge, whether it is based on data, scientific methods and models, practical experiences or on the agenda of a relevant stakeholder group. The expert panel is given the questions beforehand, and they also provide a written response for the citizen panel.

On the second day of the conference the citizen panel have the chance to ask follow-up questions to the experts. Afterwards it is time for the citizen panel to formulate their recommendations. The citizen panel will begin by deciding on issues for which they would like to write their recommendations. Then they are divided into groups where they will formulate their recommendations, starting with their observations - *what newly acquired knowledge has caught their attention*, followed by their assessment – *how do they perceive this knowledge*, and finally their recommendations – *what should be done*. When the groups have formulated their recommendations, they will present them to the rest of the citizen panel, discuss them and receive feedback. Finally, they will adjust their recommendations accordingly. This process of feedback and adjusting continues until the citizen panel have reached consensus on all recommendations.

On the third day the recommendations are presented to the expert panel, who will have the opportunity to correct factual misunderstandings, but not the opinions expressed in the recommendations. Afterwards, to conclude the conference, the citizen panel present their recommendations to relevant decision makers (national, regional, or local) as well as the media.

Read more about the Consensus Conference in the Engage 2020 Action Catalogue.

2.2 Consensus Conference in an open schooling context

The Consensus Format Open-ended Scenario is a restructuring of the Consensus Conference method to fit the open schooling approach.

With inspiration from the Consensus Conference the class or a selected group of 12-30 students will go through a process similar to the citizen panel, facilitated by their teacher. The students will gain knowledge on their chosen agenda through the expert panel, which will include local stakeholders, scientists, and other actors

with relevant knowledge within the chosen topic. Families will moreover be included to support the students in the process.

The aim is to trigger students' interest in STEM by approaching it from a different perspective. A perspective that puts societal needs and values at the core of their science education. It is moreover to empower the students and encourage their scientific confidence by using scientific knowledge to come up with actual solutions for challenges they experience in their own community and everyday life.

The Consensus Format Open-ended Scenario is, as the Consensus Conference, well suited for controversial and conflict-ridden challenges (such as climate change, land use, urban planning, emerging technologies within health care, COVID-19 prevention). The process is designed to provide comprehensive insight into the complexities at stake, by approaching it from different perspectives. The students are hereby exposed to and learn to navigate different types of knowledge. They moreover learn to debate and reach agreement on a well-informed and knowledge-based foundation. The learning objectives throughout the six steps of the Consensus Format Open-ended Scenario are to have the students acquire key scientific skills such as analysing everyday life problems they experience in their own local community, do research and use it for agenda setting. They will learn to structure and formulate research questions and map relevant stakeholders. In the interaction with the expert panel the students will be introduced to different scientific methodologies, disciplines, and perspectives, hereby learning to approach challenges from a holistic perspective. They will learn to analyse data as well as navigate conflicts of interests.

Collaboration and communication skills are moreover essential throughout the entire process, but particularly in the final steps. Here the students will come to an agreement on how to draw conclusions from the knowledge they have gathered and turn it into recommendations. Building strong arguments as well as presenting reasoned explanations and the rationale behind these are also important skills in the final stage of the process.

The process is moreover designed to engage the students' families, in order for them to learn alongside their child and hereby master these skills, improving their scientific understanding, interest, as well as confidence together.

2.3 Steps of the Consensus Format Open-ended Scenario

When going through the Consensus Format Open-ended Scenario it is important that the students follow their interests. What they find interesting, and intriguing should be a guiding point for the direction of each step of the process.

Another guiding point is reaching consensus in the class. All decisions that the students must make, whether it is deciding on a challenge in the *Framing* step or it is the recommendations they will formulate in the *Recommendation* step, the class should come to agreement, as consensus is the fundament of the process. The "consensus" sought is not a heartfelt agreement, but rather a "negotiated"

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agreement, that everyone can “live with”; the highest possible, common denominator.

The process is meant to be carried out face to face, each step can however be adopted to an online or hybrid version is necessary.

Framing

As the citizen panel sets the agenda themselves in a Consensus Conference, the students will also choose a local challenge that they want to work with by going through a couple of tasks:

Example – differentiating topics and challenges.

Topic – The ocean.
Decided upon in the Framing step.

↓

Challenge – Pollution in the ocean.
Decided upon in the Framing step.

Examples are inspired by the Danish Consensus Conference *Our Ocean* (*Vores Hav*, https://voreshav.dk/)

Figure 5 Example – differentiating topics and challenges.

1) *Brainstorm at home* – the first task is to come up with an overall topic the class wants to explore. The students will start by discussing topics they find interesting and relevant in the context of their own local community, at home with their families.
2) *Clustering topics in class* - the students will share their ideas for topics and collectively cluster similar topics on the blackboard. The class will then discuss the different topics brought forward and decide on one topic that would be interesting to work with. The class should reach agreement on the topic through debating different aspects of the topics brought up.
3) *Research on topic* – when a general topic has been decided upon the students will narrow in on a specific local challenge they want to explore. To do so, the students will first do some research on the overall topic that has been decided upon. They will explore current challenges related to the chosen topic. Ideally the students will search for relevant articles themselves. Alternatively, the teacher can provide articles, relevant search words or relevant educational material. The articles should preferably be from local newspapers or with a local perspective. This task can be done in smaller groups or individually.
4) *Questions for expert* – the students will discuss in class what they have learned from the articles and come up with 3-4 initial research questions for a relevant expert (local stakeholder or scientist), who will help the class narrow in on a specific challenge to work with. The teacher will facilitate the contact with the expert, who will provide a written or recorded reply to the questions.
5) *Deciding on a challenge* – based on this new information the class will agree on a specific local challenge that they want to work with. It is important that it is a challenge they find interesting and relevant.

Reaching consensus on a controversial topic can be quite challenging and it is important that the teacher facilitate the process and support the students in formulating well-structured arguments as well as help them listen to each other and understand each other's perspectives.

The purpose if this step is to have the students make a well-informed decision on a challenge to work with, in the following steps of the process within a topic, they find interesting and intriguing.

Experts to consult can be found in the member database of the CONNECT online Platform.

Acquired skills: Analysing everyday life problems, agenda setting, research, well-informed debate, formulating research questions.

6-7 hours is recommended for this step, excluding teacher's preparation.

Questions

In this step the students will prepare research questions for the expert panel, with support from their families:

1) *Writing research questions and suggesting experts* - students will discuss the local challenge that has been decided upon in class, at home with their families. They will discuss the knowledge they have gathered through their initial research and the expert consultation. Based on this knowledge the students will together with their families come up with 1-2 research questions for the expert panel. It is important that they also consider what they find interesting and relevant regarding this specific local challenge when formulating the questions. Afterwards, the students and their families will come up with proposals for local experts that would be relevant to include in the expert panel (specific local experts or types of experts from academia, civil society, government, or private sector).
2) *Categorising* – the students will present their questions and input on experts (names or types) in class. The class will then categorise questions and put together overlapping questions and experts. In this task it is important that the teacher help the student cluster the questions in order to avoid repetition as well as to make sure that all aspects of the challenge are covered in the questions. If relevant areas, controversies, or perspectives are not represented in the research questions presented by the students, the teacher can help the class come up with questions covering these aspects. This can also be done in consultation with the expert from previous step.

In this step, it is also important that the research questions and suggested experts take a point of departure in what the students find interesting about the challenge they are working with.

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The purpose for this step is to prepare for the expert panel. These research questions will set the basis for the knowledge acquired by the students, from which they will write their recommendations. It is thus important that they capture all elements, controversies and opinions related to the challenge.

Acquired skills: Formulating research questions, analysing everyday life problems, agenda setting, stakeholder mapping.

1-2 hours is recommended for this step, excluding teacher's preparation and homework.

Knowledge and opinions

The *Knowledge and opinions* step is inspired by the first day of the Consensus Conference, whereas previous steps are inspired by the preparatory worked carried out by the citizen panel. In the first day of the conference the citizen panel will receive the expert panels replies to their questions. The students will thus, in this step consult with an expert panel:

1) *Expert panel* – the teacher will set up an expert panel of 4-5 experts based on the suggestions provide by the students and their families. The panel will receive the questions beforehand and provide a written as well as an oral reply to the questions. Time for follow up questions after each presentation should be set aside.

Having the students meet with the expert panel is the traditional and preferred format. Adapting this step to the recourses of the teacher is however also an option. The expert panel can be online or a hybrid, having some provide their replies online and others can visit the class. Having experts visit the class one by one over a period of time is also an option. Whatever format may be chosen, it is important to continuously refresh the students' memory for them to have all the different perspectives in mind and not only the last one they have heard when formulating their recommendations.

The inclusion of different types of knowledge is key in the consensus conference. Experts should thus be scientists or researchers, but local stakeholders (from civil society, government, and private sector) with relevant knowledge within the field should also be included in the expert panel. It is important that the expert panel is diverse, representing different scientific fields (economic, legal, social, environmental, ethical, technological, political etc.) as well as context relevant perspectives and opinions – providing a wholesome picture of the challenge. Experts participating in the expert panel should be thoroughly instructed in not only presenting their perspectives or opinions, but also what these perspectives and opinions are based upon - whether it is scientific data, methods, models or if it is a specific agenda, interest, or practical experiences. These should be well explained to the students, in order for them to understand the grounds of their arguments. The purpose of this step is, through the consultation with experts, to gain knowledge and understanding of the different risks at stake related to the

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local challenge at hand, which is fundamental for the students to formulate well-informed and knowledge-based recommendations, hence putting scientific knowledge into the context of society and using this knowledge to influence local decision-making.

The teacher can also consult the expert consulted in the *Faming* step or search the member database of the CONNECT online Platform to find relevant experts for the expert panel, if necessary.

Acquired skills: Analysing data, understanding different scientific methods and disciplines, understanding different types of knowledge and perspectives, understanding conflict of interests and how to approach an issue from different perspectives.

2-3 hours is recommended for this step, excluding teacher's preparation and homework.

Deliberation

This step is structured around the first part of formulating recommendations, where the students will discuss and agree on which issues, they will write their recommendations:

1) *Discuss findings from the expert panel* – the students will share and discuss what they have learn from the expert panel at home with their families. They will discuss what the students found most interesting and urgent to act upon.
2) *Mapping and deciding on issues* – the class will discuss what they have talked about a home as well as the outcome of the process - what they have learned so far, what they found particularly interesting in the replies by the expert panel and the issues raised they find most urgent to create solutions for. Based on this discussion the class will decide on 3-4 issues for which they will write their recommendations.

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The purpose of this step is for the class to agree on issues they find most urgent to act on and hence most relevant for formulating their recommendations. It is important that the class agrees on the chosen issues. It is moreover for the students to discuss and reflect upon the knowledge they have gather throughout the process – what have they learned? What has been the most surprising perspective or information? What have had the biggest impact on them?

Issues are specific problem areas related to the challenge at hand, for which the students would like to come up with recommended solutions. Following the example above, with inspiration from the Danish Consensus Conference *Our Ocean*[5], specific issues may be plastic waste, release of nutrients into the ocean (nitrogen and phosphorus) and xenobiotics released into the ocean. The students should choose the issues they find most relevant and urgent to act upon.

Example – differentiating topics, challenges, and issues.

Topic – The ocean.
Decided upon in the Framing step.

↓

Challenge – Pollution in the ocean.
Decided upon in the Framing step.

↓

Issues – Plastic waste, release of nutrients into the ocean (nitrogen and phosphorus), xenobiotics released into the ocean.
Decided upon in the Deliberation step.

Examples are inspired by the Danish Consensus Conference Our Ocean (Vores Hav, https://voreshav.dk/)

Figure 6 Example – differentiating topics, challenges, and issues.

Acquired skills: well-informed debate, communication, collaboration, analyse data, interpret, and draw knowledge-based conclusions.

1-2 hours is recommended for this step, excluding teacher's preparation and homework.

Recommendations

The students will in this step formulate their recommendations by going through a number of tasks:

1) *Write recommendations in groups* – the students will be divided into 3-4 groups, one group per issue decided upon. The groups will write their recommendations (including their observations and assessment) on the issues they have been assigned.
2) *Plenary feedback* – when groups have written the first draft for their recommendation, they will present it to the class. The class will discuss the recommendations and provide feedback for each other – Do they agree in the recommendation and the argumentation behind it (observations and assessment)? Do they find the arguments and formulations clear and understandable? Is anything missing?

[5] Vores Hav, *https://voreshav.dk/*

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3) *Adjusting recommendations* – based on the feedback given by the class, groups will adjust their recommendations.
4) *Feedback at home* – Students will present the recommendation their group have formulated, at home for their families who will provide feedback and input – Do they find the argumentation and formulations clear and understandable? Is anything missing?
5) *Adjusting recommendations* – based on the feedback given by the families, groups will adjust their recommendations.
6) *Repeat tasks* – the class will repeat task 2 and 3 (as well as 4 and 5 if necessary) until consensus is reached on all recommendations, through debate.
7) *Factual approvement* (optional but recommended) – the class can ask the expert panel to fact check the recommendations. The expert panel is however not allowed to make changes or influence the opinions expressed in the recommendations.

The students will use their newly acquired knowledge to act on the local challenge they are working with by writing recommendations for local decision-makers, stakeholders, and media. It is important that the recommendations are well-argued and presents the opinion of the class.

To ensure the impact of the Consensus Conference it is important that the citizen panel, a demographically representative group of citizens come to agreement and stand as a unit representing their recommendations. Particularly when dealing with controversial and conflict-ridden issues, as the issues dealt with in a Consensus Conference typically are.

In the case of the Consensus Format Open-ended Scenario, although the class may not be demographically representative (in terms of age, gender, ethnicity, family income, level of education), the importance of consensus remains, not only as it is at the core of the method but also because it sends a stronger message to the recipients of the recommendations (local decision-makers, stakeholders, and media).

Well-argued recommendations include observations, assessment, and recommendation. The citizens, or in this case the students, begin by formulating their *observations* about the given issue they are writing their recommendation. The observations are the factual knowledge they find interesting regarding the issue – What information/facts have they taken special notice of, or did they find particularly relevant? Based on these observations they write their *assessment* - How do they respond to this information (what do they make of it)? Finally, they will, based on their observations and assessment, write their *recommendation* – What should be done?

If this process of writing observations, assessment and recommendations is challenging for the students it can also be done backwards – what should be done (recommendations)? Why do we respond to the issue in this way (assessment)? Which facts are these based on (observations)?

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Acquired skills: evidence-based decision making, participate in a well-informed debate, communication, collaboration, peer-review, building arguments, respect for different opinions.

4-12 hours is recommended for this step, depending on how fast the class can reach consensus. Excluding teacher's preparation.

Dissemination

The Consensus Format Open-ended Scenario ends off with the students disseminating their recommendations to those who can act on the issue:

1) *Presenting recommendations* – The teacher will arrange a meeting with relevant policymakers (e.g. local government, city council), stakeholders and media and each group will present their recommendation. Afterwards the recommendations (observations, assessment, and recommendations) should be handed over in written form as well. The expert panel can also be invited but it is optional.

The purpose here is to inspire relevant policymakers and/or stakeholders to act on the challenge the students have been working with and provide solid, knowledge-based solutions for doing so. The local media is moreover important to disseminate the recommendations to the public as well as to put pressure on local decision-makers to take action. The expert panel can also be invited.

This is the ideal format, which is recommended. However, as it may be hard to reach local decision-makers or too time consuming for the teachers to arrange such a meeting, other solutions are also possible – such a writing articles or campaigns on social media, either through the schools or with help from the families.

Acquired skills: communication, understanding of the political arena.

1 hour is recommended for this step, excluding teacher's preparation.

2.4 Roles and responsibilities

It is important that the students are supported by their teacher, families, and experts as they go through the process of the Consensus Format Open-ended Scenario.

The teacher will facilitate the process, ensure that the class is on the right track, guide the discussions and help reach consensus on the different decisions the class will make. The teacher will moreover find and communicate with relevant experts, decision-makers, stakeholders, and media who will participate in the different steps.

Experts for the expert panel can be scientist or researchers with expertise within the challenge the students are working with. They can also be local stakeholders and other actors who have relevant knowledge on the challenge. It is important

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that the expert panel is a diverse group representing different fields and opinions. The expert panel will provide information and knowledge in order for the students to make well-informed, knowledge-based decisions.

The students' families are moreover involved in several tasks throughout the process in order for the families support their child in the learning process towards scientific confidence. The families should help their child navigate the challenge and follow their interest. The engagement of the families is moreover important to help ensure that the focus stays rooted in the local community throughout the process.

3. Information materials

For the Consensus Format Open-ended Scenario different information materials has been developed to support the involved parts. All material developed is found in the appendix (1-4).

The Teacher's guide includes:

- Overall information on the Open-ended Scenario and purpose of the process.
- Information about the Consensus Format Open-ended Scenario, overview of the process and the teacher's role.
- Detailed description of each step of the process, including tasks, acquired skills and time needed for each step,
- Self-assessment tool for teachers.

The students' sheets include:

- An overall introduction to the Consensus Format Open-ended Scenario,
- Description of task to carry out in each step, including explanation of the purpose of these task and tips on how to carry out the tasks,
- Self-reflection exercise for students.

The family information sheets includes:

- Overall information on the Open-ended Scenario and purpose of the process,
- Information about the Consensus Format Open-ended scenario process and the family's role.

The expert information material includes:

- Overall information on the Open-ended Scenario and purpose of the process.
- Information about the Consensus Format Open-ended scenario process and expected contributions from involved experts.

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4. References

The Danish Board of Technology Foundation, https://tekno.dk/focus_area/responsible-research-innovation/?lang=en

Engage2020 Action Catalogue "*Consensus Conference":* http://actioncatalogue.eu/method/7413

Vores hav "*Konsensuskonference*": https://voreshav.dk/hvordan/

The Danish Board of Technology "*Konsensuskonferencer (Pjece)*": https://tekno.dk/project/konsensuskonferencer-pjece/

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5. Appendix

5.1 Teacher's guide

CONNECT

Inclusive open schooling with engaging and future-oriented science

Consensus Format
Open-ended Scenario

Teacher's guide

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www.connect-science.net

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The Open-ended Scenario

The EU-funded CONNECT project aims at increasing student's interest and self-esteem in STEM.

The Open-ended Scenarios sets out to trigger students' interest in science by aligning science education with societal needs and values through the adaptation of participatory methods to open-schooling processes, an inclusive and flexible learning environment.

The Open-ended Scenario Framework contains six steps, two for each of the CONNECT Science Action stages – CARE, KNOW, DO. The students go through a process of finding a local challenge they find interesting (CARE), learning about the challenge (KNOW) and formulate and disseminate recommendations (DO).

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The Consensus Format Open-ended Scenario

The Consensus Format Open-ended Scenario is a restructuring of the Consensus Conference method to fit the open schooling approach.

The Consensus Format Open-ended Scenario is, as the Consensus Conference, well suited for controversial and conflict-ridden challenges (such as climate change, land use, urban planning, emerging technologies within health care, COVID-19 prevention). The process is designed to provide comprehensive insight into the complexities at stake, by approaching it from different perspectives. The students are hereby exposed to and learn to navigate different types of knowledge. They moreover learn to debate and reach agreement on a well-informed and knowledge-based foundation.

The learning objectives throughout the six steps of the Consensus Format Open-ended Scenario are to have the students acquire key scientific skills such as analysing everyday life problems they experience in their own local community, do research, and use it for agenda setting. They will learn to structure and frame research questions and map relevant stakeholders. In the interaction with the expert panel the students will be introduced to different scientific methods, disciplines, and perspective, hereby learning to approach challenges from a holistic perspective. They will learn to analyse data as well as navigate conflicts of interests.

Collaboration and communication skills are moreover essential throughout the entire process, but particularly in the final steps. Here the students will come to an agreement on how to draw conclusions from the knowledge they have gathered and turn it into recommendations. Building strong arguments as well as presenting reasoned explanations and the rationale behind these are also important skills in the final stage of the process.

When going through the Consensus Format Open-ended Scenario it is important that the students follow their interests. What they find interesting, and intriguing should be a guiding point for the direction of each step of the process. Another guiding point is reaching consensus in class. All decisions that the students must make, whether it is deciding on a challenge in the *Framing* step or it is the recommendations they will formulate in the *Recommendation* step, the class should come to agreement, as consensus is the fundament of the process.

Reaching consensus

To ensure the impact of the recommendations that the students will formulate it is important that they come to an agreement and stand as a unit representing their recommendations. It will send a stronger message to the recipients of the recommendations (local decision-makers, stakeholders, and media).

Reaching consensus on a controversial topic can be quite challenging and it is important that the teacher facilitate the process and support the students in formulating well-structured arguments as well as help them listen to and understand each other's perspectives. As a facilitator, the teacher will also ensure that all opinions are heard and that everyone in the class will have their say.

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The “consensus” sought is not a heartfelt agreement, but rather a “negotiated” agreement, that everyone can “live with”; the highest possible, common denominator.

The teacher’s role

The teacher will facilitate the process, ensure that the class is on the right track, guide the discussions and help reach consensus on the different decisions the class will make. The teacher will moreover find and communicate with relevant experts, decision-makers, stakeholders, and media who will participate in the different steps.

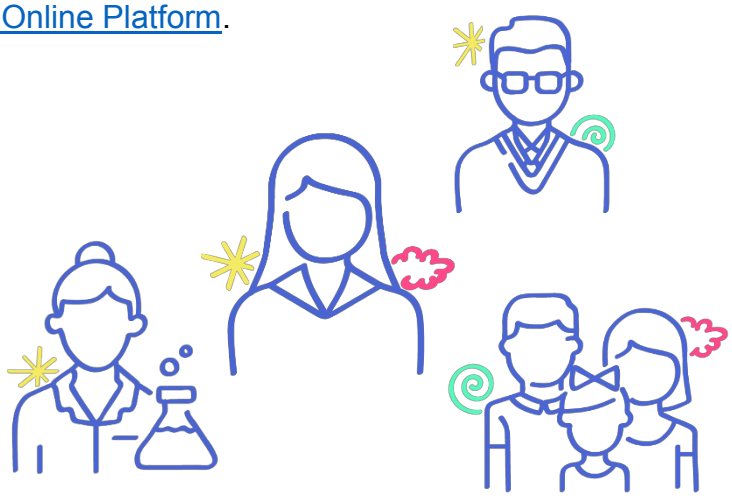
Experts for the expert panel can be scientist and researchers, but it can also be other local stakeholders, such as representatives from civil society organisations, government, and industry. It is important that the expert panel represents different perspectives and opinions, across scientific disciplines and interests. These perspectives and opinions presented should of course be well reasoned and context relevant, but they can originate from different types of knowledge, whether it is based on data, scientific methods and models, practical experiences or on the agenda of a relevant stakeholder group. The expert panel will provide information and knowledge in order for the students to make well-informed, knowledge-based decisions.

The students’ families are moreover involved in several tasks throughout the process in order for the families support their child in the learning process towards scientific confidence. The families should help their child navigate the challenge and follow their interest. The engagement of the families is moreover important to help ensure that the focus stays rooted in the local community throughout the process.

Besides this teacher’s guide, self-assessment tools, student sheets, information sheets for families and experts as well as presentation materials are also provided.

Videos with tips to facilitate discussions and conversations are found in the CONNECT YouTube Channel.

Experts for the expert panel can moreover be found in the member database in the CONNECT Online Platform.



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Framing

The purpose of this step is to trigger the students' interest by having them make a well-informed decision on a local challenge they find interesting and would like to work with.

Science action stage: **CARE**

Participants: **Families**, **Experts**

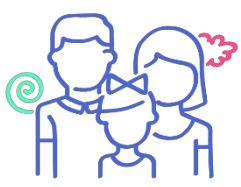
It is important that the teacher facilitate the process, help the class reach agreement on a topic as well as find and facilitate the communication with a relevant expert. Experts to consult can be found in the member database of the CONNECT online Platform.

Tasks:

1) *Brainstorm at home* – The first task is to come up with overall topics the class would find interesting to explore. The students will start by discussing topics they find interesting and relevant in the context of their own local community, at home with their families.

2) *Clustering topics in class* - The students will share their ideas for topics and collectively cluster similar topics on the blackboard. The class will then discuss the different topics brought forward and decide on one topic that would be interesting to work with. The class should reach agreement on the topic through debating different aspects of the topics brought up. Online tools such as Padlet, Mural, Miro or Google Drive can be useful for this task if adapting to an online format becomes necessary.

3) *Research on topic* – When a general topic has been decided upon the students will narrow in on a specific local challenge they want to explore. To do so, the students will first of do some research on the overall topic that has been decided upon. They will explore current challenges related to the chosen topic. Ideally the students will search for relevant articles themselves. Alternatively, the teacher can provide articles, relevant search words, or relevant educational material. The articles should preferably be from local newspapers or with a local perspective. This task can be done in smaller groups or individually.



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4) *Questions for expert* – The students will in class discuss what they have learned from the articles and come up with 3-4 initial research questions for a relevant expert (local stakeholder, researcher, or scientist), who will help the class narrow in on a specific challenge to work with. The teacher will facilitate the contact with the expert, who will provide a written or a recorded reply to the questions.

5) *Deciding on a challenge* – Based on this new information the class will agree on a specific local challenge that they want to work with. It is important that it is a challenge they find interesting and relevant.

Acquired skills: Analysing everyday life problems, agenda setting, research, well-informed debate, formulating research questions.

Time: 6-7 hours is recommended for this step, excluding teacher's preparation.

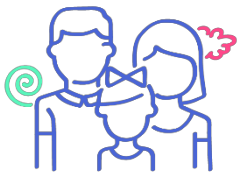
Example – differentiating topics and challenges.

Topic – The ocean.
Decided upon in the Framing step.

↓

Challenge – Pollution in the ocean.
Decided upon in the Framing step.

Examples are inspired by the Danish Consensus Conference *Our Ocean* (*Vores Hav*, https://voreshav.dk/)



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Questions

Science action stage: **CARE**

Participants: **Families**

This step will have the students explore their interest in the challenge they have decided upon. They will discuss the challenge with their families and what they would like to know more about the challenge. Based on this discussion they will come up with research questions and suggested experts for the expert panel.

In this step it is also important that the research questions and suggested experts takes a point of departure in what the students find interesting about the challenge they are working with.

The research questions will set the basis for the knowledge acquired by the students, from which they will write their recommendations. It is thus important that they capture all elements, controversies and opinions related to the challenge. If relevant areas (controversies, or perspectives) are not represented in the research questions presented by the students, the teacher can help the class come up with further questions covering these aspects. This can also be done in consultation with the expert from previous step to ensure all areas are covered.

Tasks:

1) *Writing research questions and suggesting experts* - Students will discuss the local challenge that has been decided upon in class, at home with their families. They will discuss the knowledge they have gathered through their initial research and the expert consultation. Based on this knowledge the students will together with their families come up with 1-2 research questions for the expert panel. Afterwards, the students and their families will come up with suggestions for local experts that would be relevant to include in the expert panel (specific local experts or types of experts from academia, civil society, government, or the private sector).

2) *Categorising* – The students will present their research questions and proposals for experts in class. The class will then categorise and put together overlapping research questions, making them ready for the expert panel. In this task it is important to help to student cluster the questions in order to avoid repetition as well as to make sure that all aspects of the challenge are covered. Help the students come up with further questions, if necessary.

Acquired skills: Formulating research questions, analysing everyday life problems, agenda setting, stakeholder mapping.

Time: 1-2 hours is recommended for this step, excluding teacher's preparation and homework.

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Knowledge and Opinions

Science action stage: **KNOW**

Participants: **Experts**

The purpose of this step is, through the consultation with experts, to gain knowledge and understanding of the different perspectives and opinions related to the local challenge at hand. This knowledge is fundamental for the students to formulate well-informed and knowledge-based recommendations.

Experts should be scientists or researchers as well as local stakeholders (from civil society, government, and private sector) with relevant knowledge within the field. It is important that the expert panel is diverse, representing different scientific fields (economic, legal, social, environmental, ethical, technological, political etc.) as well as context relevant perspectives and opinions – providing a wholesome picture of the challenge. Experts participating in the expert panel should be thoroughly instructed in not only presenting their perspectives and opinions, but also what these perspectives and opinions are based upon – whether it is scientific data, methods, models or if it is a specific agenda, interest, or practical experiences. These should be well explained to the students, for them to understand the grounds of their arguments. The teacher can also consult the expert from the *Faming* step or search the member database of the CONNECT online Platform to find further relevant experts for the expert panel.

Task:

1) *Expert panel* – The teacher will set up an expert panel of 4-5 experts based on the suggestions provide by the students and their families. The panel will receive the questions beforehand and provide a written as well as an oral reply to the questions. Time for follow up questions after each presentation should be set aside.

Having the students meet with the expert panel is the traditional and preferred format. Adapting this step to the recourses of the teacher is however also an option. The expert panel can be online or a hybrid, having some provide their replies online and others can visit the class. Having experts visit the class one by one over a period of time is also an option. Whatever format may be chosen, it is important to continuously refresh the students' memory for them to have all the different perspectives in mind and not only the last one they have heard when formulating their recommendations.

Acquired skills: Analysing data, understanding different scientific methods and disciplines, understanding different types of knowledge and perspectives, understanding conflict of interests and how to approach an issue from different perspectives.

Time: 2-3 hours is recommended for this step, excluding teacher's preparation and homework.

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Deliberation

Science action stage: **KNOW**

Participants: **Families**

The purpose of this step is for the class to discuss what they have learned and agree on 3-4 issues they find most urgent to act on and hence most relevant for their recommendations. It is important that the class agrees on the chosen issues. It is moreover for the students to discuss and reflect upon the knowledge they have gather throughout the process – what have they learned? What has been the most surprising perspective or information? What have had the biggest impact on them?

Tasks:

1) *Discuss findings from the expert panel* – The students will share and discuss what they have learn from the expert panel at home with their families. They will discuss what they found most interesting and urgent to act upon.

2) *Mapping and deciding on issues* – The class will discuss what they have talked about at home as well as the outcome of the process - what they have learned so far, what they found particularly interesting in the replies from the expert panel and the issues raised they find most urgent to create solutions for. Based on this discussion the class will decide on 3-4 issues for which they will write their recommendations.

Example – differentiating topics, challenges, and issues.

Topic – The ocean.
Decided upon in the Framing step.

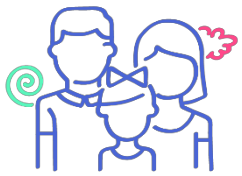
↓

Challenge – Pollution in the ocean.
Decided upon in the Framing step.

↓

Issues – Plastic waste, release of nutrients into the ocean (nitrogen and phosphorus), xenobiotics released into the ocean.
Decided upon in the Deliberation step.

Examples are inspired by the Danish Consensus Conference Our Ocean (Vores Hav, https://voreshav.dk/)



Acquired skills: Well-informed debate, communication, collaboration, analyse data, interpret, and draw knowledge-based conclusions.

Time: 1-2 hours is recommended for this step, excluding teacher's preparation and homework.

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Recommendations

Science action stage: **DO**

Participants: **Families**

The students will use their newly acquired knowledge to act on the local challenge they are working with by writing recommendations for local decision-makers, stakeholders, and media. It is important that the recommendations are well-argued and presents the opinion of the class.

Well-argued recommendations include observations, assessment, and recommendation. The students begin by formulating their *observations* – What information/facts have they taken special notice of, or did they find particularly relevant? Based on these observations they write their *assessment* - How do they respond to this information (what do they make of it)? Finally, they will, based on their observations and assessment, formulate their *recommendation* – What should be done?

If this process of writing observations, assessment and recommendations is challenging for the students it can also be done backwards.

Tasks:

1) *Write recommendations in groups* – The students will be divided into 3-4 groups, one group per issue decided upon. The groups will write their recommendations (including their observations and assessment) on the issues they have been assigned.

2) *Feedback* – Groups will present their recommendation to the class. The class will discuss the recommendations and provide feedback for each other - – Do they agree in the recommendation and the argumentation behind it (observations and assessment)? Do they find the arguments and formulations clear and understandable? Is anything missing?

3) *Adjusting recommendations* – Groups will adjust their recommendations based on the feedback given by the class.

4) *Feedback at home* – Students will present the recommendation their group have formulated, at home for their families who will provide feedback and input – Do they find the argumentation and formulations clear and understandable? Is anything is missing?

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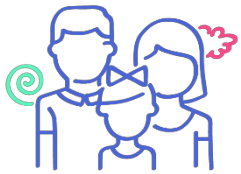
5) *Adjusting recommendations* – Based on the feedback given by the families, groups will adjust their recommendations.

6) *Repeat tasks* – The class will repeat task 2 and 3 (as well as 4 and 5, if necessary) until consensus is reached on all recommendations through debate.

7) *Factual approvement* (optional but recommended) – The class can ask the expert panel to fact check the recommendations. The expert panel should however not make changes or influence the opinions expressed in the recommendations.

Acquired skills: Evidence-based decision making, participate in a well-informed debate, communication, collaboration, peer-review, building arguments, respect for different opinions.

Time: 4-12 hours is recommended for this step, depending on how fast the class can reach consensus. Excluding teacher's



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Dissemination

Science action stage: **DO**

Participants: **Local policy-makers, stakeholders and media**

The purpose here is to inspire relevant policymakers (e.g. local government, city council) and/or stakeholders to act on the challenge the students have been working with and provide solid, knowledge-based solutions for doing so. The local media is moreover important to disseminate the recommendations to the wider public as well as to put pressure on local decision-makers to take action.

Tasks:

1) *Presenting recommendations* – The teacher will arrange a meeting with relevant policymakers, stakeholders, and media. Each group will present their recommendation. Afterwards the recommendations (observations, assessment, and recommendations) should be handed over in written form as well. The expert panel can also be invited but it is optional.

This is the ideal format, which is recommended. However, as it may be hard to reach local decision-makers or too time consuming to arrange such a meeting, other solutions are also possible – such a writing articles or campaigns on social media, either through the schools or with help from the families.

Acquired skills: communication skills, understanding of the political arena.

Time: 1 hour is recommended for this step, excluding teacher's preparation.

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Self-assessment tool for teachers - Under development

This self-assessment tool sets out to help you evaluate and ensure the quality of the open-ended scenario process as well as to spot changes that may be necessary to make the process engaging for the students. We recommend reflecting on these questions, together with the self-assessment tool for students not just at the end of the process but also throughout the process in order to adjust the process if necessary.

Practicalities

Was the process practically applicable?
Why / why not?
What worked well?
What did not work so well?

Student involvement

How did you experience the process to be different from traditional, non-participatory learning programmes?
Which differences did you experience in the students' involvement in scientific topics?
How did the process manage to capture the interest of students who are not usually interested in scientific topics?

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What captured the student's interest in the process? Any steps/tasks specifically?
How did the process help empower students and increase their confidence in their scientific skills?

Participation

How did you manage to engage different participants (scientists, researchers, local stakeholders, families)?
How did the different participants contribute to the students' learning?
How did the different participants contribute to the students' involvement?

Learning objectives

Did the students become familiar with different types of knowledge?				
1	2	3	4	5
All the students did	Most of the students did	Some of the students did	Few of the students did	None of the students did
In which step(s) did they become familiar with different types of knowledge?				

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Did the students learn to navigate conflicts of interests?				
1	2	3	4	5
All the students did	Most of the students did	Some of the students did	Few of the students did	None of the students did
In which step(s) did they learn to navigate conflicts of interests?				
Did the class learn to debate and reach agreement on a well-informed and knowledge-based foundation?				
1	2	3	4	
Absolutely	To some extent	Only to a limited extent	Not at all	
In which step(s) did they learn to debate and reach agreement on a well-informed and knowledge-based foundation?				
Did the students learn to analyse everyday life problems they experience in their own local community?				
1	2	3	4	5
All the students did	Most of the students did	Some of the students did	Few of the students did	None of the students did
In which step(s) did they learn to analyse everyday life problems they experience in their own local community?				
Did the students learn to conduct research and use it for agenda setting in the *Framing* step?				
1	2	3	4	5
All the students did	Most of the students did	Some of the students did	Few of the students did	None of the students did
Did the students learn to structure and formulate research questions in the *Framing* and *Questions* steps?				
1	2	3	4	5
All the students did	Most of the students did	Some of the students did	Few of the students did	None of the students did
Did the students get an idea of how different stakeholder groups can be influenced by a challenge?				

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1 Absolutely	2 To some extent	3 Only to a limited extent	4 Not at all
In which step(s) did they get an idea of how different stakeholder groups can be influenced by a challenge?			
Were the students introduced to different scientific methods, disciplines, and perspective, hereby learning to approach challenges from a holistic perspective?			
1 Absolutely	2 To some extent	3 Only to a limited extent	4 Not at all
Did the class become better at collaborating throughout the process?			
1 Absolutely	2 To some extent	3 Only to a limited extent	4 Not at all
Did they learn to communicate scientific issues and build strong arguments?			
1 Absolutely	2 To some extent	3 Only to a limited extent	4 Not at all
Did they learn to draw conclusions from the knowledge they have gathered and turn it into recommendations			
1 Absolutely	2 To some extent	3 Only to a limited extent	4 Not at all

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EXUS
Greece
www.exus.co.uk

OU
Uk
www.open.ac.uk

DBT
Denmark
www.tekno.dk

IRSICAIXA
Spain
www.irsicaixa.es/en/livinglabhealth

MSc
Uk
www.shop.masteryscience.com

VUT
Romania
www.valahia.ro

LOBA
Portugal
www.loba.pt

UNEB
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CONNECT

Inclusive open schooling with engaging and future-oriented science

Consensus Format
Open-ended Scenario

Student sheets

info@connect-science.net

www.connect-science.net

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Consensus Format Open-ended Scenario

Your class is about to do an experiment, a new way of approaching science education. You will go through a research process that sets out to put local challenges you experience in your own community in focus from the perspective of science.

In this research process you will:

- Identify a problem and set a research agenda,
- Formulate research questions,
- Conduct research and consult with experts,
- Draw conclusions and come up with possible solutions.

These solutions will be presented for local decision-makers helping them and inspire them to act upon the challenge.

You will engage with experts who will help you understand the challenge you are working with from different perspectives.

Your family will also be involved and support you throughout the process.

When doing this experiment your most important tasks are to:

1) Listen to your classmates and try to understand their perspectives, also if they are different from yours.

2) Let your interests guide you. This experiment is an opportunity for you to explore your interests.

3) Have fun!

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Preliminary self-reflection exercise for students - Under development

This preliminary self-reflection tool will help you reflect upon what you have learned throughout the six step process. You will start by rating your level of confidence in applying different scientific skills. At the end of the process you will do this rating again and see what you have learned in the process. If you do not feel confident using these skills – do not worry! The process is designed to help you learn them. If you do – great! Let us apply them.

Please rate how confident you are when:

Structuring and formulating research questions?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Doing research?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Analysing scientific data?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Drawing conclusions?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

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Framing

In this step the class must decide on a local challenge you want to work with. You will discuss topics you find interesting at home and in class, gather information, and decide on a specific challenge to work with.

LOCAL CHALLENGES

Something that affects you, your family, or your neighbours.

It could be within the topics of health and food, technologies, energy, the environment, society-society, or climate change.

Tasks:

AT HOME

1) *Brainstorm* – Discuss topics that would be interesting to work with. What would be relevant in relation to our own local community?

IN CLASS

2) *Cluster* – Present the topics you have come up with at home to the class. Together you will cluster them together. Afterwards you will discuss the topics and decide on one to work with.

IN GRUOPS

3) *Research* – Search for information on the topic you have decided upon in local newspapers.

IN CLASS

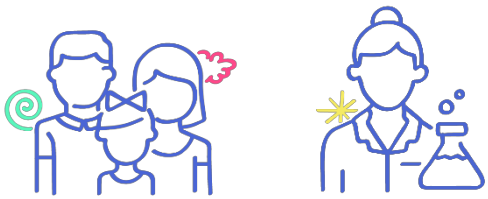
4) *Questions for expert* – Discuss what you have found and learned in your research. Come up with 3-4 initial research questions for an expert:

- Any specific challenges you would like to know more about?
- Have any questions come up while doing research?

IN CLASS

5) *Deciding on a challenge* – based on your new knowledge you will agree on a local challenge to work with.

Topics:
1. Why..
2.



Asking questions:

Always ask open questions. Instead of questions that can be answered with yes/no, ask ***why, how*** or ***what.***

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Questions

In this step you will come up with research questions and suggestions for the expert panel. The expert panel will help you understand the challenge you are working with so you can come up with knowledge-based suggested solutions for local decision-makers.

What is an expert?

Someone who has relevant knowledge regarding the challenge you are working with. It can be a scientist, a researcher, or a local stakeholder.

A stakeholder is someone who has something at stake. Local actors who have influence on or are influenced by the challenge you are working with.

It can be: The local shopkeeper, an investor, a city council employee or someone from a relevant civil society organisation.

Tasks:

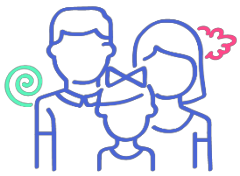
AT HOME

1) *Writing research questions and suggesting experts* – You will:
   - Discuss the local challenge that has been decided upon in class and what you have learned so far.
   - Come up with 1-2 research questions for the expert panel. What do you find interesting and relevant regarding the challenge? What would you like to learn about the challenge? Use the knowledge gathered in the first step.
   - Finally, come up with a suggestion for a local expert that would be relevant to include in the expert panel (specific local expert or type of expert).

IN CLASS

2) *Categorising* – In order to prepare for the expert panel, you will present your questions and expert suggestion in class. You will then put together overlapping questions.

Questions:
1. Why..
2.
Suggestions for expert (name and/or type):



Asking research questions:

Always ask open questions. Instead of questions that can be answered with yes/no, ask ***why, how*** or ***what.***

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Knowledge and Opinions

In this step you will consult with the expert panel, who will answer your questions. It is a good idea note down follow up questions for the experts and to note down interesting arguments and facts, which you will use for formulating your recommendations in the following steps.

Tasks:

IN CLASS

1) *Expert panel* – The expert panel present a reply to the class' questions. Afterwards the class can ask follow up questions.

Notes:

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Deliberation

In this step you will discuss what you have learned from the expert panel and what issues you find most urgent to act on. Based on this discussion you will come up with 3-4 issues for which you will be writing your recommendations.

Listening to your classmates

In this step it is important that the class agrees on the issues which you will be formulating your recommendations. To do so you have to listen to your classmates' opinions and try to understand their perspectives.

Tasks:

AT HOME

1) *Discuss findings from the expert panel* – Share with your family what you have learned from the expert panel and discuss:
   - What was the most surprising reply? Why?
   - What was the most interesting reply? Why?
   - What issues were discussed, and which do you think are the most urgent to act on?

IN CLASS

2) *Mapping and deciding on issues* – You will discuss:
   - What have you learned from the expert panel?
   - Which information and facts did you find particularly relevant and interesting?

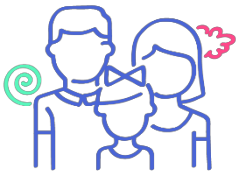
   Based on this discussion you will agree on 3-4 issues for your recommendations in next step.

Building an argument

It is also important that you make your opinions clear, so your classmates can understand your perspective.

Building an argument is pretty much the same as formulating recommendations (see next step):

- What facts are relevant to the issue being discussed?
- What do you take from these facts? How do you understand them?
- What does these facts mean for the issues you are discussing?



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Recommendations

In this step you will formulate recommendations on the selected issues that will encourage and inspire local decision-makers to act. Each group will be assigned one issue for which they will write their recommendation.

Issue assigned:

Tasks:

IN GROUPS

1) *Write recommendations in groups* – Write your recommendations based on your observations and assessment.

IN CLASS

2) *Plenary feedback* – Each group will present their recommendation (including observations and assessment) to the class. The class will discuss the recommendations and provide feedback for each other.

IN GROUPS

3) *Adjusting recommendations* – Groups will adjust their recommendations based on the feedback given by the class.

AT HOME

4) *Feedback* – Present the recommendation your group have formulated to your family, who will provide feedback.

5) *Repeat tasks* – Repeat task 2 and 3 (and 4-5 if necessary) until the class agrees on all recommendations.

How to write recommendations:

Well-argued recommendations include observations, assessment, and recommendation:

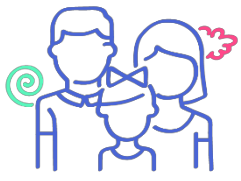
1) O*bservations* – What information/facts have you taken special notice of, or do you find particularly relevant in relation to the issue you are working with?

2) A*ssessment* - How do you respond to this information? (what do you make of it)

3) *Recommendation* – What can we do about the issue?

You should start with your observations which will be the fundament for your assessment of the issue and finally, based on these, your solution for to the problem, your recommendation.

If this is difficult you can also try to do it the other way around, starting with your recommendation and then go into the reason for this recommendation (observations and assessment).



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Recommendations
Observations
Assessment
Recommendation

Feedback: Do you agree in the recommendation and the argumentation behind it (observations and assessment)? Do you find the arguments and formulations clear and understandable? Is anything missing?

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Dissemination

In this step you will present your recommendations to whom they are addressed: local policy-makers who can act on the issues touched upon. The media will also be invited to communicate the recommendations to the public and to help put pressure on the policy-makers to take action.

Tasks:

1) *Presenting recommendations* – Each group will present their recommendation to local policy-makers, stakeholders and media. Beforehand the group should decide who will present what (observations, assessment, recommendation).

You will present:

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Concluding self-reflection exercise for students - Under development

This self-reflection tool will help you and your teacher to evaluate the process as well as to ensure that you will have fun and learn many interesting and new things. it will moreover help you reflect upon what you have learned and identify skills that you have learned.

Please rate how confident you are when:

Structure and formulate research questions?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Doing research?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Analysing scientific data?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

Draw conclusions?

1	2	3	4	5
Very insecure	Insecure	Neutral	Confident	Very confident

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Experience

Did you have fun?	Yes, absolutely ☐	It was fine ☐	Not much ☐	Not at all ☐
Why/why not?				
Which step(s)/task(s) was the most fun? Why?				
Which step(s)/task(s) was the most difficult? Why?				
Did you feel like your opinion was heard in the different steps?	Yes, absolutely ☐	To some extent ☐	Not really ☐	Not at all ☐
Did you feel like the decision-makers listened to your recommendations?	Yes, absolutely ☐	To some extent ☐	Not really ☐	Not at all ☐
Did you find the topic you have been working with interesting?	Yes, absolutely ☐	It was fine ☐	Not really ☐	Not at all ☐
Why/why not?				

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Knowledge

What have you learned? Summarise the three main messages/concepts you have learned.				
What did you learn about different opinions and perspectives - supported by facts, data, well-structured arguments?				
What was the main learning outcome from your interaction with science professionals?				
What were their occupation (professional career)?				
Do you feel inspired by them? Why?				
Would you like to learn more about the topic you have been working with?	Yes, absolutely ☐	Sure ☐	Not really ☐	Not at all ☐
Would you like to learn more about topics similar to the topic you have been working with?	Yes, absolutely ☐	Sure ☐	Not really ☐	Not at all ☐
Could you give some examples?				

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EXUS
Greece
www.exus.co.uk

OU
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www.open.ac.uk

DBT
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www.tekno.dk

IRSICAIXA
Spain
www.irsicaixa.es/en/livinglabhealth

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5.3 Information for families

Your child's class will in the following weeks go through a processed called an open-ended scenario. It is developed by the EU-funded project CONNECT, which aims at increasing student's interest and self-esteem in STEM (Science, Technology, Engineering, Mathematics).

The process sets out to trigger students' interest in STEM by putting a focus on challenges societal needs and values in science education.

Through six steps the students will go through a process of finding a local challenge they find interesting, learning about the challenge as well as formulate and disseminate recommendations encouraging local decision-makers (e.g. local government, city council) to act on this challenge. An overview of the six steps is provided below, explaining the learning objectives of each step.

In this process reaching agreement within the class is very important. Thus, there will in the following weeks be a lot of focus on listening to and trying to understand each other's perspectives as well as on how to build valid arguments.

Your role as family member

Throughout this process different participants will be engaged to support the students. Students will consult with different experts. Family members will also support the students throughout the process. Families are particularly involved in the steps:

- Framing
- Questions
- Deliberation
- Recommendations

When going through this open-ended scenario it is important that the students follow their interest and curiosity regarding the challenge they are working with. We would moreover like to encourage you to support your child in this throughout the process, by discussing what they have learned in each step and what they find particularly interesting about the challenge and related issues.

Below please find and overview of the process, explaining the learning objectives of each step. Explanations of the three steps, which families are involved are further included. Students will also be provided student sheets explaining all six steps.

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OPEN – ENDED SCENARIO FRAMEWORK

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Framing

In this step the class must decide on a local challenge they want to work with. You will help your child come up with overall topics they would find interesting to work with in the first task. Afterwards the class will discuss the topics, gather information, and decide on a specific challenge to work with.

LOCAL CHALLENGES

Something that affects your child, your family, or your neighbours.

It could be within health, food, the environment, energy, transportation, society.

Tasks:

AT HOME

1) ***Brainstorm* – Discuss topics that would be interesting to work with. Talk about challenges you experience in your own community – to which topics do they relate? What topics are your impassioned about?**

IN CLASS

2) *Cluster* – Students will present the topics you have come up with at home to the class. Together they will cluster them together. Afterwards they will discuss the topics and decide on one to work with.

IN GRUOPS

3) *Research* – Students will search for information on the topic you have decided upon in local newspapers.

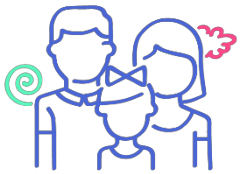
IN CLASS

4) *Questions for expert* – students will discuss what they have found and learned in their research. They will come up with 3-4 questions for an expert:

   a. Any specific challenges you would like to know more about?
   b. Have any questions come up while doing research?

IN CLASS

5) *Deciding on a challenge* – based on their new knowledge they will agree on a local challenge to work with.



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Questions

In this step you will help your child come up with questions and suggestions for the expert panel. The expert panel will help them understand the challenge they are working with so they can come up with knowledge-based suggested solutions for local decision-makers.

What is an expert?

Someone who has relevant knowledge regarding the challenge you are working with. It can be a scientist, a researcher, or a local stakeholder.

A stakeholder is someone who has something at stake. Local actors who have influence on or are influenced by the challenge you are working with.

It can be: The local shopkeeper, an investor, or a city council employee or someone from a relevant civil society organisation.

Tasks:

AT HOME

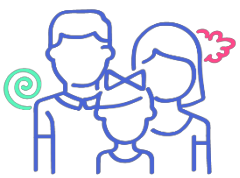
1) ***Writing questions and suggesting experts*** **– You will:**
   a. **Discuss the local challenge that has been decided upon in class and what your child have learned so far. What information were most intriguing? What was most surprising?**
   b. **Come up with 1-2 questions for the expert panel. What does your find particularly interesting and relevant regarding the challenge? What would you like to learn about the challenge? Use the knowledge gathered in the first step.**
   c. **Finally, come up with a suggestion for a local expert that would be relevant to include in the expert panel (name on specific local experts or types of experts that would be relevant to talk to).**

IN CLASS

2) *Categorising* – In order to prepare for the expert panel, students will present their questions and expert suggestion in class. Then they will put together overlapping questions.

Asking questions:

Always ask open questions. Instead of questions that can be answered with yes/no, ask ***why, how*** or ***what.***



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Deliberation

In this step your child will share what they have learned from the expert panel, and you will discuss interesting issues that are most urgent to act upon. Afterwards the class will discuss and agree on 3-4 issues on which they will formulate their recommendations.

Listening to your classmates

In this step it is important that the class agrees on the issues which you will be formulating your recommendations. To do so you have to listen to your classmates' opinions and try to understand their perspectives.

Tasks:

AT HOME

1) ***Discuss findings from the expert panel*** **– Talk about what your child have learned from the expert panel and discuss:**
   a. **What was the most surprising reply? Why?**
   b. **What was the most interesting reply? Why?**
   c. **What issues were discussed, and which are the most urgent to act on?**

IN CLASS

2) *Mapping and deciding on issues* – The students will discuss:
   a. What have you learned from the expert panel?
   b. Which information and facts did you find particularly relevant and interesting?

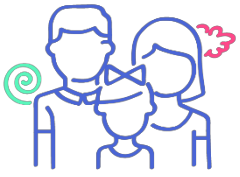
   Based on this discussion the class will agree on 3-4 issues for their recommendations in next step.

Building an argument

It is also important that you make your opinions clear, so your classmates can understand your perspective.

Building an argument is pretty much the same as formulating recommendations (see next step):

- What facts are relevant to the issue being discussed?
- What do you take from these facts? How do you understand them?
- What does these facts mean for the issues you are discussing?



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Recommendations

In this step students will formulate recommendations on the selected issues that will encourage and inspire local decision-makers to act. Each group will be assigned one issue for which they will write their recommendation. You will provide feedback on the recommendation your child's group have formulated.

Tasks:

IN GROUPS 1) *Write recommendations in groups* – Students write their recommendations based on their observations and assessment.

IN CLASS 2) *Plenary feedback* – Each group will present their recommendation (including observations and assessment) to the class. The class will discuss the recommendations and provide feedback for each other.

IN GROUPS 3) *Adjusting recommendations* – Groups will adjust their recommendations based on the feedback given by the class.

AT HOME **4) *Feedback* – Your child will present their recommendation and you will provide feedback:** Do you find the arguments and formulations clear and understandable? Is anything missing?

5) *Repeat tasks* – Repeat task 2 and 3 (and 4-5 if necessary) until the class agrees on all recommendations.

How to write recommendations:

Well-argued recommendations include observations, assessment, and recommendation:

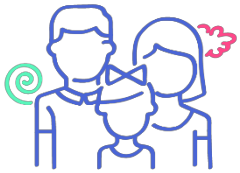
1) O*bservations* – What information/facts have you taken special notice of, or do you find particularly relevant in relation to the issue you are working with?

2) A*ssessment* - How do you respond to this information? (what do you make of it)

3) *Recommendation* – What can we do about the issue?

You should start with your observations which will be the fundament for your assessment of the issue and finally, based on these, your solution for to the problem, your recommendation.

If this is difficult you can also try to do it the other way around, starting with your recommendation and then go into the reason for this recommendation (observations and assessment).



5.4 Information material for experts

The EU-funded CONNECT project aims at increasing student's interest and self-esteem in STEM.

The Open-ended Scenarios sets out to trigger students' interest in science by aligning science education with societal needs and values through the adaptation of participatory methods to open-schooling processes, an inclusive and flexible learning environment.

In six steps the students will go through a process of finding a local challenge they find interesting, learning about the challenge as well as formulate and disseminate recommendations encouraging local decision-makers to act on this challenge.

Your role as an expert

As an expert you will take part in an expert panel, who will provide knowledge and information, in the *Knowledge and opinions* step, for the students to make well-informed and knowledge-based recommendations for local decision-makers.

You will be provided with a number of questions formulated by the students. You will, as part of the expert panel, present your replying to the class as well as provide a written reply. After your presentation, the students will have the opportunity to ask follow up questions.

Experts on the expert panel can be scientist, researchers, local stakeholders and other actors with relevant knowledge related to the challenge.

The inclusion of different types of knowledge are key in this process. It is important that the expert panel is diverse, representing different, context relevant perspectives and opinions – providing a wholesome picture of the challenge. As a participant in the expert panel, it is important that you not only present your perspectives or opinions, but also what these are based upon – whether it is scientific data, methods, models or if it is a specific agenda, interest, or practical experiences. These should be well explained to the students, in order for them to understand the grounds of your arguments.

As part of the expert panel, you can moreover be asked to clarify, elaborate or fact check the students' recommendations, however this will be done online or in written form.

If you are asked to factcheck recommendations, we kindly ask you to only respond to the facts included in the recommendations, as the experts should not influence the opinions expressed in the recommendations.

Time and place of the expert panel will be arranged by the teacher.

Your engagement is highly appreciated and valuable for students who will benefit from this close interaction with experts so as they can improve their perceptions about science and feel that "science is for them".

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OPEN – ENDED SCENARIO FRAMEWORK

SCIENCE ACTION STAGES	WE care	WE know	WE do
STEPS	Framing Questions	Knowledge & opinions Deliberation	Recommendations Dissemination
LEARNING OBJECTIVES	To **discuss and trigger students' interest** in community-based and socio-scientific issues	To **acquire scientific understanding** of local issues supported by scientists To **collaboratively develop** alternative solutions	To **communicate science** projects to the local community To contribute to **local decision making** processes

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5.6 Presentation material

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Consensus Format Open-ended scenario

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Open-ended Scenarios

The Open-ended Scenarios sets out to trigger students' interest in STEM (Science, Technology, Engineering, Mathematics) by aligning science education with societal needs and values through the adaptation of participatory methods to the open schooling agenda, an inclusive and flexible learning environment.

In six steps the students will go through a process of finding a local challenge they find interesting, learning about the challenge as well as formulate and disseminate recommendations encouraging local decision-makers to act on this challenge.

Consensus Format Open-ended Scenario

- The Consensus Format Open-ended Scenario is a restructuring of the Consensus Conference method to fit the open schooling approach.
- The students will gain knowledge on their chosen agenda through the expert panel, which will include local stakeholders, scientists, and other relevant actors with relevant knowledge within the chosen topic. Families will moreover be included to support the students in the process.
- The aim is encourage students' scientific self-esteem by using scientific knowledge to come up with actual solutions for challenges they experience in their own community and everyday life.
- The Consensus Format Open-ended Scenario is, as the Consensus Conference, well suited for controversial and conflict-ridden challenges (such as climate change, land use, urban planning, emerging technologies within health care, COVID-19 prevention). It will teach the students to navigate different perspectives and opinions as well as to debate and reach agreement on a well-informed and knowledge-based foundation supported by data, facts and concepts.

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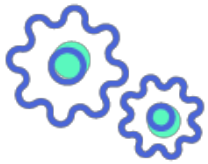
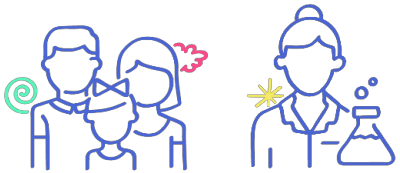
Faming





Tasks:

1) *Brainstorm at home* – Discuss topics that would be interesting to work with.

2) *Clustering topics in class* – Cluster students' suggestions and decide on a topic to work with.

3) *Research on topics* – Narrow in on a specific local challenges the class want to explore through research.

4) *Questions for expert* – Come up with 3-4 questions for a relevant expert who will provide further information to narrow in on a challenge to work with.

5) *Deciding on a challenge* – The class will agree on a specific local challenge that they want to work with.

Acquired skills: Analysing everyday life problems, agenda setting, research, well-informed debate, formulating research questions.

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Questions

Tasks*:*

1) *Writing questions and suggesting experts* - Students will discuss the local challenge at home with their families and come up with 1-2 questions for the expert panel. Afterwards, they will come up with suggestions for a local expert that would be relevant to include in the expert panel.

2) *Categorising in class* – The students will present and categorise their questions and input on experts (names or types) in class.

Acquired skills: Formulating research questions, analysing everyday life problems, agenda setting, stakeholder mapping.

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Knowledge and opinions

Tasks:

1) *Expert panel* – the teacher will set up an expert panel of 4-5 experts based on the suggestions provide by the students and their families.

Acquired skills: Analysing data, understanding different scientific methods and disciplines, understanding different types of knowledge, perspectives, and opinions, understanding conflict of interests and how to approach an issue from different perspectives.

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Deliberation

Tasks:

1) *Discuss findings from the expert panel* – the students will share and discuss what they have learn from the expert panel at home with their families. They will discuss what the students found most interesting and urgent to act upon.

2) *Mapping and deciding on issues* – The class will discuss the outcome of the process and decide on 3-4 issues for which they will write their recommendations.

Acquired skills: well-informed debate, communication, collaboration, analyse data, interpret, and draw knowledge-based conclusions.

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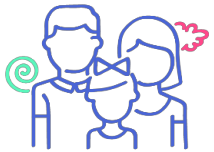
Recommendations



Tasks:

1) *Write recommendations in groups* – In groups the students will write their recommendations (observations, assessment, and recommendations), one group per issue.

2) *Feedback* – Groups will present their recommendation and receive feedback.

3) *Adjusting recommendations* – Groups will adjust their recommendations.

4) *Feedback at home* – Students will present their recommendations to their families and receive feedback.

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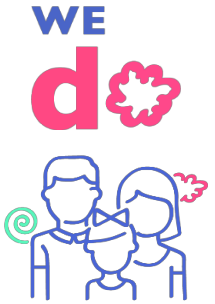
Recommendations



Tasks (continued):

5) Adjusting recommendations – Groups will adjust their recommendations based on the feedback given by their families.

6) Repeat tasks– The class will repeat task 2 and 3 (as well as 4 and 5) until consensus is reached on all recommendations.

7) Factual approvement (optional) – The class can ask the expert panel to fact check the recommendations.

Acquired skills: Well-informed debate, communication, writing, interpret, draw and present knowledge-based conclusions, collaboration, peer-review, building arguments.

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Writing recommendations

Well-argued recommendations include observations, assessment, and recommendation:

1) O*bservations* – What information/facts have you taken special notice of, or do you find particularly relevant in relation to the issue you are working with?
2) A*ssessment* - How do you respond to this information? (what do you make of it)
3) *Recommendation* – What can we do about the issue?

You should start with your observations which will be the fundament for your assessment of the issue and finally, based on these, your solution for to the problem, your recommendation.

If this is difficult you can also try to do it the other way around, starting with your recommendation and then go into the reason for this recommendation (observations and assessment).

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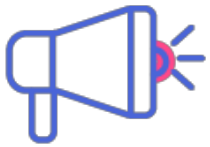
Dissemination



Tasks:

1) *Presenting recommendations* – Each group will present their recommendation to local policy-makers, stakeholders and media. The expert panel can also be invited but it is optional.

Acquired skills: communication, understanding of the political arena.

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Materials available

- Teacher's guide
- Student sheets
- Information for families
- Information material for experts
- Self-assessment

All materials are available in the CONNECT Platform.

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