



## About the activity

**Name:** Bees for the future

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**Main topic(s) that includes:** Biodiversity, Environmental Sciences, Bees, populations, Ecosystem, web of life

**Brief description (1 to 2 paragraphs):** Students will discover what is the importance of bees for human life as well as for the whole ecosystem and will investigate how their communities and the communities that live in other islands are behaving towards bees. Bees have been a major contemporary science concern, as their numbers have been decreasing at a fast rate. Considering this, students from the different islands will collaboratively figure out solutions to improve community awareness and conservation strategies in the islands.

**Subject domain(s):** Biology, Environmental Sciences, Health, Economy,

**Keywords:** Bees, Biodiversity, Ecosystem, Population, Extinction

**Possible collaborations:**

Biology: ecosystems, biodiversity, bee's behavior, etc

Mathematics: Beehive mathematic patterns, Fibonacci sequence

Environmental Sciences: ecosystems, pesticide use, protecting bee populations

Health: Harms of pesticide use for animals and humans

Psychology: People's habits and relation with the environment, willingness to change, etc.

Economy: different agricultural practices and their impact on economy, impact of bee extinction on economy, etc.

English: collaboration among islands of different countries requires the English language



## Resources for this activity

- **Students' project:** <https://portal.opendiscoveryspace.eu/en/osos-project/bees-future-852292>
- **Collaborative data-gathering project:**  
[https://globallab.org/en/project/cover/abelhas\\_para\\_o\\_futuro.en.html#.XDh3olz7TIU](https://globallab.org/en/project/cover/abelhas_para_o_futuro.en.html#.XDh3olz7TIU)
- **Inquiry Learning Scenario (ILS) included in this activity:**  
<http://graasp.eu/ils/5baca3a461326fb1d3d44f32/?lang=en>

Inside the OSOS project, in the “imagine” phase, students will have access to an online Inquiry activity in a platform called **Graasp**. You can choose to let your students access the Inquiry activity directly through the link given to them in the OSO project with no additional effort from your part.

### Optional:

If you want to have access to what your students have done in the Graasp platform, use the learning analytics and use this data for evaluation purposes, you can choose to create an account in **Graasp** and make a copy of the Inquiry activity by accessing this link: <https://www.golabz.eu/ils/humans-and-bees> and completing the following steps:

1. Click preview to see what the platform will look like for your students
2. Go back to: <https://www.golabz.eu/ils/humans-and-bees>
3. Click “duplicate space”
4. The system will generate a copy that will be yours and you will access the “backstage” of the activity.
5. Make all the changes that you want, if you want.
6. On the top right of the screen you will see the “share” button



7. Click on the button and then on “Show standalone view”
8. This will be the link you will share with your students. Make sure you give them this link or that you edit the “imagine” phase of the OSOS project, before sharing it with students, and add the correct link

**Note:** your students should introduce their names and in the backstage (by clicking in the icon with the shape of a person on the bar (as shown in the image above), you can scroll down and will be able to see exactly what each student does in the platform.

You can find more information here: <http://support.golabz.eu/>



## Interdisciplinarity in this activity

This activity is created under an interdisciplinary framework by connecting the topics taught with the Big Ideas of Science. Teachers implementing different activities can create an interdisciplinary approach if they are related to the same Big Ideas of Science. Teachers from different subject domains can also work together in the same activity and use this Map to discover how the activity relates to their subject domains, in an interdisciplinary view.

In order to discover to which other topics you can relate this activity, visit the 3D Interdisciplinary Map of Science Ideas here: <http://platon.ea.gr/elements-table>. Type the name of the Big Idea of Science you want to investigate in the search engine and discover many other related topics.

For an overview of the Big Ideas of Science and their progress from the Small to the Intermediate Ideas, please visit the following [mindmap](#).

### Big Ideas of Science:



#### **Evolution>Natural Selection and Darwinian Theory>Adaptation**

Students will understand that bees might not be able to adapt to the threats that humans are imposing to their environment and might, thus, go extinct.

#### **Evolution>Biodiversity>Biodiversity, plants and animals**

Students will understand the importance of biodiversity for the survival of species and the ecosystems they belong to.



#### **Earth>Ecosystems>Interdependent relationships in ecosystems**

Students will learn about the interdependence of all elements of an ecosystem, reflecting on what could happen to humans and other animals and plant species if bees went extinct.



#### **Energy>Forms, conservation of energy and energy transfer, >Conservation and Degradation of energy**

Students can be recalled that Energy is transformed from one form to another. Bees use pollen as food which gives them energy. Bees need to find all the energy supplies they need in order to survive.

#### **Energy>Forms, conservation of energy and energy transfer > Heat and thermodynamics**

The laws of thermodynamics shape the climate of our planet. Excessive amounts of heat produced on Earth can raise the temperature of the planet and have an impact on climate changes.



## General advice for teachers

- Throughout the whole activity make sure that you establish a pleasant and positive working environment;
- Help your students understand that being wrong is a very important step of the learning process;
- Ensure that your students work in heterogeneous groups with a balance between genders;
- Help the introvert students to share their opinions and thoughts;
- Make sure that all students have the same opportunities to participate in the activity;
- Never give your students the answers to the questions but guide them into finding the answers by themselves;
- Be very patient with your students, they might not be used to this type of activity yet;
- Read this document very carefully and make sure you feel comfortable with it before you introduce the activity to your students;
- Use the Inquiry-Under-the-Microscope toolkit to help your role in this activity it here: <http://platon.ea.gr/content/inquiry-under-microscope>. See the table below to understand which components can be useful in the different phases of the activity
- Good luck! ☺

Design Thinking Step	Most relevant Inquiry Components
Feel	<b>IC1:</b> Setting the scene <b>IC3:</b> Wondering about how something works <b>IC5:</b> Doing research and collecting data <b>IC6:</b> Interpreting data and drawing conclusions <b>IC7:</b> Comparing conclusions to hypothesis and existing theory <b>IC9:</b> Discussing and connecting with everyday life
Imagine	<b>IC2:</b> Refreshing prior knowledge <b>IC3:</b> Wondering about how something works <b>IC4:</b> Thinking about how to test hypotheses <b>IC8:</b> Reviewing and reflecting on what has been done
Create	<b>IC2:</b> Refreshing prior knowledge <b>IC5:</b> Doing research and collecting data <b>IC6:</b> Interpreting data and drawing conclusions <b>IC7:</b> Comparing conclusions to hypothesis and existing theory <b>IC8:</b> Reviewing and reflecting on what has been done
Share	<b>IC1:</b> Setting the scene <b>IC2:</b> Refreshing prior knowledge <b>IC8:</b> Reviewing and reflecting on what has been done <b>IC9:</b> Discussing and connecting with everyday life



## Tips for each phase of the activity

### 1. Feel

This is the most extensive phase of the activity. It is the phase where students will become familiar with the topic in question. They will be introduced to the general problem, to the most relevant concepts, relate it to their previous knowledge, make hypotheses and reach conclusions. Students will raise their curiosity and motivation to investigate this problem further, at a local level – their community.

#### Tip 1

When you share the project with the students give them their access information (as described [here](#)) and make sure they understand that they must keep this information and always login with the same username and password.

#### Tip 2

Throughout this phase five questions are presented in different ways for the students and they are asked to discuss them with the class. The questions are: 1-do you like bees? 2-Are bees important? 3-What do bees give to us? 4-What do we give to bees? 5-what would happen if bees disappeared? Although these questions are addressed in different ways in the activity, to increase the students' engagement you can create a Mentimeter board where each student will use their smartphone or other device to answer to the questions anonymously and display all the answers in the screen.

For this, you should follow these steps:

- 1 - Access: <https://www.mentimeter.com>
- 2 – Register and log in to your area
- 3 – Click on “Create New Presentation” and name it as you wish
- 4 – On the right side of the screen select Multiple Choice, Image choice, word cloud or whatever type of quiz you want
- 5 – Write your question “do you like bees?” and on the options write yes/no and any other option you want. Do the same for all the other questions.



- 6 – Customise your answer layout as you wish
- 7 – On the top right side of the screen click “Present” and a screen will appear with the code that your students have to insert on “menti.com” and with the results. Give this code to your students.
- 8 – Present each question at a time and when you select the next question, your students will also see it on their devices and be able to answer to them.
- 9 – If you want to hide the results until all students have answered you can click on the little wheel on the left bottom side of the screen and choose “hide results”.

You can make this procedure before or after sharing the activity with the students and you can do it for just one of the questions, like the first one “do you like bees” to introduce the activity, or choose the ones you want to make.

You can also use [Padlet](#), which is an online board where each student can make notes. You can add to this board any question you find suitable for this phase of the activity.

#### **Tip 3**

Your students will start working on their projects and will ask to play the “web-of-life” game (instructions come as an accompanying file of this activity). This game will illustrate to them in a fun and interactive way the importance of all the elements of an ecosystem, including bees. You can play it with them.

Make sure that you focus this game on Bees and on human impact on Bees!

#### **Tip 4**

With the help of a [project created in a collaborative data collection platform](#) called “globallab” students will be able to collect data related to the situation of the bee population of their island (if it is increasing, stable or decreasing), the level of awareness of the members of their community and how the community as a whole behaves toward bees. Furthermore, by following a strict protocol to collect this data, they will be able compare their results with those from other islands and learn from them, reflect on if and why they are different and what they can do to improve their community or contribute for the development of others.

Read the globallab project carefully before you implement this activity with your students. The project includes one protocol that you should read carefully and your students too.



**Important note:** please make sure that your students register in globallab with a code name. For example: First letter of your name + second letter of your second name + student school number + group letter. You can choose what best suits you. Also, we advise you to make sure that your student's do not enter pictures that identify them in the platform, due to privacy assurance. Make sure your students save their access data.

### Tip 5

Encourage your students to register all their ideas and the conversations they have with their community members. They can write everything in a digital or paper notebook or record the conversations with permission of the community members. Let them come up with their own ideas but guide them into respecting and valuing the opinions and thoughts of their community members. Make key questions to help them reflect on how their plans are suitable or not for their community.

### Tip 6

**Discussion among students:** In the globallab platform, in each project, on the left side bar your students will find the “Discussion” utility. This is a discussion place that students should use to communicate with others from other islands, share their results and their ideas and exchange good community examples. This can help promote the sense of an international community and the mutual support between young people that live far away but in similar situations.

Make sure that each group interacts with at least one student/group from other island and keeps exchanging ideas throughout the project.

Guide your students in their data analysis if you think they are not used to doing it. Make sure they establish the correct correlations and think critically about the data. Let them manipulate and play with the data as much as they want. This is their project and its important that they use their creativity.

### **Main skills being developed in this phase:**

- Communication
- Critical Thinking



- Information and communication
- Language and texts

**Accompanying files for this phase:**

- [1-How to share the project with the students.pdf](#)
- [3-Bees for Future WebOfLife GameInstructions.pdf](#)
- [4-Bees for Future Theory-Teacher.pdf](#)

**2. Imagine**

**Description:** After having “felt” the problem on which they will be working on and realizing how it relates to their community, students will begin to think about what the causes of the problem are and discover possible solutions.

**Tip 1**

Anytime your students decide to go to their community to make questions or discuss an issue, make sure they know exactly what they want to ask/say in order for the “field trip” to be effective. However, do this by always asking questions that will make them reflect and reach conclusions, instead of giving them the answers.

**Tip 2**

If possible, during this phase of the project, arrange a field trip with your students to a place of their choice, related to the problem at hands. It can be to a University where experts work on this problem, or maybe to a beekeeper’s working place.

**Tip 3**

Motivate your students to involve the community when looking for solutions. Advise them to discuss the problem with their families and if possible, invite them to participate in the project and be part of it.

**Tip 4**

This type of project might be very new to your students. If this is the case, try to keep a positive and calm attitude so as to help them to adjust to such an innovative way of working. Provide them all the support you can.

**Tip 5**



During this phase your students will visit an online activity where they will make a research about the causes of the problem. In this activity they will follow a 5 step Inquiry activity. The first step resembles the Feel phase of their project, reason why they should ignore it and begin in the second step “Be a scientist and make your hypothesis”.

Be present during this phase and make sure that your students understand what a hypothesis is and how to create one. However, do not create hypotheses for them or correct them if their hypotheses are wrong. They will test their hypotheses in the next phase and discover whether it was right or wrong.

### **Tip 6**

In the third phase of the Inquiry activity “Make your experiments and get results” an online simulator will be presented to your students so that they can test their hypothesis in an immediate way that would not be possible in a real-life setting. Read the “Model Info” to understand the model fundamental assumptions.

This simulator presents four sliders: “number-of-bees”, “number-of-flowers”, “n-ticks-for-a-bee” and “n-ticks-for-a-flower”. With these sliders, students can setup the initial number of bees and flowers, and the frequency at which a random individual (a bee and / or a flower) is removed. The simulator also presents the option of removing one random bee and / or one random flower manually by clicking the respective button. It also allows students to print charts and download them as image in order to analyse the results and upload them to their projects.

If an experiment is run with the default start-up values of the four variables mentioned before, one can see that the system is self-sustainable. That is, bees pollinate flowers allowing for the maintenance of flowers’ population numbers, and at the same time, flowers provide the pollen for honey production by bees. However, if one sets the variable “n-ticks-for-a-bee” to 100 (for example), then, a random bee will be removed every 100 ticks (the net logo time unit). Bees will all die after 1500 ticks and flowers will not be pollinated in their life-time. So, flowers will become extinct. Symmetrically, if one sets the variable “n-ticks-for-a-flower” to 100 (for example), then, a random flower will be removed every 100 ticks. Flowers will all die after 1500 ticks and bees will not have pollen for honey production and nectar to feed themselves, which means returning to the beehive and feed on honey after each trip in search for flowers. But because the accumulated honey is finite, bees will eventually die without anything to feed on.



In a more practical example: If students have hypothesised that chemicals decrease the bee population because they kill all the wild flowers, than in the simulator they should decrease the number of flowers (as if they were dying) to see what would happen to bees if this happened in real life. If students hypothesise that if bees disappear than flowers will disappear too, than they should set the simulator to remove bees and see what happens to the flowers.

Students should use the simulator for a few minutes, understand how it works, and then design a plan on which will use the simulator to test their hypothesis.

Your students will have to decide on how to use the simulator to test their hypothesis. At first, it might seem to them that it is impossible to test them, because the simulator only present variable "flowers" and variable "bees". However, you can lead into realizing that many of the human activities affect bees because they reduce their number (by killing them) or drastically reduce the number of flowers in the region (by destroying natural fields for monocultures, for example). So, thinking like that, the model might allow for the testing of most of the student's hypotheses, even if in an indirect way.

Make sure that your students remember that they should change only one variable at a time in order to know which of the factor was influencing their results. Alternatively, let them discover this by themselves by asking them "*so how do you know which of the variables influenced this result?*" in case they didn't pay attention to that.

Allow your students to run multiple trials until they feel like they have enough data to retrieve meaningful conclusions.

### Tip 7

In the phase "What did you discover?" make sure that your students use arguments that are well sustained by the data they collected from their experiments. If their hypotheses were correct, they should use their data to show it, if they were incorrect, based on their data they should explain why they were wrong and why they have changed their mind.

### Tip 8

In the final phase of the Inquiry activity "Share with your class and discuss!", students should reflect on their results, discover if all groups reached the same conclusions and if not, what could have caused such difference.



You can take a moment to discuss with them how what they did could be done by actual researchers and the importance of using virtual models like they did in order to prevent any damage or interference with natural populations. Technology has brought us many advantages, and this is one of them.

**Main skills being developed:**

- Reasoning and Problem Solving
- Creative Thinking
- Information and communication
- Scientific, technical and technological knowledge
- Interpersonal relations

### 3. Create

**Description:** After having collected all the information they need from their communities and imagining possible solutions or ways of action, it is time to put hands on action and start creating the final result of their work.

#### Tip 1

Students should create something of value for the community, based on the discussions and opinions of the community. Students and teachers should be creative in this part and decide what would be the most effective product to offer to their communities or to the other communities with which they have worked. During the creation, students should have an active attitude always. The teacher will only be a pillar for support and guidance when needed. Allow your students to make mistakes and correct them. Let them be creative. Be patient if you note that your students are feeling insecure. They might not be used to such activities. Offer them words of confidence and support and encourage them to keep motivated and put energy into their work.

Suggestions of possible outcomes:

- Design a community garden with the bees' needs in mind – many different species of flowering plants that are natural in the region and include a poster or a few stations that bring awareness to the community.
- Construct a beehive with a poster as above.
- Organize and promote a certain number of community debates about the problems that bees are facing today.



- Create a flyer about bees, their importance for the ecosystem, the problem they are facing and possible solutions. The same for the local wildflowers pollinated by bees.
- Create a theatre or a performance that illustrates the problem bees are facing.
- Make an exhibition about this topic and invite the community to visit it.
- Etc.

**Main skills being developed:**

- Interpersonal relations
- Wellbeing, Health and Environment
- Scientific, technical and technological knowledge
- Aesthetical and artistic sensitivity

**Inspirational Videos:**

- [Video 1](#)
- [Video 2](#)

**4. Share**

After finishing their projects and creating their final outcome, encourage each group to create some type of record of what they did, either in paper or digital format, and distribute it to their colleagues. Help them create something easy to read and inspirational, that can actually help others in future projects. By doing so, your students will, themselves, be reflecting on what they did, interiorizing it much more and will organize the whole experience in their brains in a much more meaningful way.

**Important note:** If your students decided to create an output for another community, using theirs as an example, it is also very important that they share this with their own community. Raising awareness is very important for those that are already behaving in an exemplary way, as a way of showing them that they are recognized.

**Main skills being developed:**

- Interpersonal relations