Bees are the tireless workers of nature

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BioBeo

Information

BioBeo Bioeconomy Definition:

"Bioeconomy is a systems-based approach that seeks to replace fossil resources in a sustainable manner with renewable biological resources from terrestrial and marine ecosystems – such as forests, crops, animals, fish, microorganisms, organic waste, and agricultural side streams, to produce food, feed, fibres, energy, bio-based products, and services within a circular economy framework designed to optimise resource use based on a cascading hierarchy of utilisation options. A sustainable and circular bioeconomy requires the application of education and training programmes, scientific research, technology, and innovation with the aim of not only creating economic value, but also regenerating and expanding ecosystems and biodiversity as well as improving the health and the well-being of society. By addressing these systemic changes in the economy, environment, and society, the bioeconomy contributes to achieving a better and more sustainable future where no one is left behind."

Organisation: E3STEM

Country: Greece

Topic: Sustainable economy and products, beekeeping, ecosystems, bioeconomy

Narrative: Beekeeping is an important aspect of the bioeconomy because it involves the sustainable management of honeybees, which are critical for pollination and the production of honey and other bee-related products. Beekeeping also plays a key role in supporting the production of crops that rely on pollination, such as fruits, vegetables, and nuts. As a result, beekeeping contributes to the sustainable production of food and other agricultural products.

In addition, beekeeping is an important part of the bioeconomy because it provides opportunities for small-scale farmers and rural communities to participate in the production of high-value products. Honey, beeswax, and other bee-related products can be sold locally or exported to other markets, providing income for beekeepers and contributing to the local economy.

Methodology/ies: inquiry-based learning, gamification.

SDG: the scenario focuses on Goal 15 LIFE ON LAND

Age group: 5-12

Curriculum integration: Environmental Sciences, Science, Biology, Chemistry, Physics

The following themes are addressed by this Material:

	Interconnectedness ☒	**Interconnectedness** reflects the role of the biosphere and natural environments in human well-being and holistic health and the undisputed ecological interconnectedness of all living things.
	Outdoor learning ☒	**Outdoor learning** is active learning in the outdoors where participants learn through what they do, through what they encounter and through what they discover.
	Food Loop ☐	**Food Loop** encompasses farming, hospitality, retail, and energy production sectors. In terms of the circular economy, it focuses on the efficient use of by-products, and the overall reduction of food waste.
	Forestry ☒	Whilst **forestry** products are increasingly attractive in terms of sustainability, and are a major part of the circular economy, there are massive global disparities in the governance of forestry activity.
	Life Below Water ☐	**Life below water** refers to the conservation and sustainable use of all water bodies (like oceans, and marine resources but also rivers and lakes) for sustainable development.

Learning outcomes

Lesson 1

The purpose of the work plan is to introduce students to the role that small bees have in maintaining the balance in ecosystems, the wonderful cooperation they have with each other in their communities and their contribution to humans.

After completing the learning intervention, students will be able to:

1. Describe the structure of bee societies, including the roles of different types of bees within the colony.
2. Recognize the need for biodiversity and explain why bees are important for maintaining biodiversity.
3. Identify emerging products from beekeeping, such as beeswax candles and propolis supplements and their contribution to the circular bioeconomy.
4. Give examples of the contribution of bees to the conservation of biodiversity, such as through pollination of wildflowers and other plants.
5. Make artifacts using products from the natural environment, such as beeswax or honey, and explain how these products are made and used.
6. Present the results of research processes involved in learning about bees and beekeeping, such as through a class presentation or project.

Lesson Plan 1

<table>
<tr><td>Subject(s): Environmental Sciences, Science, Visual Arts, Music, Education for Sustainable Development</td><td colspan="2">Title of Lesson: Bees are the tireless workers of nature.
No. of Lesson 1 of 1</td></tr>
<tr><td>Date:</td><td>Class: PreSchool and Elementary</td><td>Time:
Duration: 7 teaching hours</td></tr>
<tr><td>BioBeo Theme:
Interconnectedness, Outdoor learning, Forestry</td><td colspan="2">Keywords/Phrases: Beekeeping, Bee, biodiversity , habitat, sustainable, ecosystem, agricultural crops, trees, and plants, bioeconomy.</td></tr>
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Learning Outcomes:

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3. Students will be able to identify emerging products from beekeeping, such as beeswax candles and propolis supplements and their contribution to the circular bioeconomy.
4. Students will be able to give examples of the contribution of bees to the conservation of biodiversity, such as through pollination of wildflowers and other plants.
5. Students will be able to make artifacts using products from the natural environment, such as beeswax or honey, and explain how these products are made and used.
6. Students will be able to present the results of research processes involved in learning about bees and beekeeping, such as through a class presentation or project.

Resources/Materials/Equipment:

Floor robot (eg BEEBOT), computers or tablets with internet connection, video projector, Simple materials, wax sheets, papers, glues, staples and paints, Canson paper, rulers, A4 sheets, colors magnifying lenses, digital photos,

Introduction:

It is important for children to learn about bee communities for several reasons:
Bees are important pollinators: Bees play a crucial role in pollinating plants, including many of the fruits and vegetables that we eat. By learning about bee communities, children can gain an appreciation for the critical role that bees play in our food systems and the importance of protecting their habitats.
Encouraging environmental stewardship: Learning about bees can help children understand the importance of caring for the environment and the impact that human activities can have on natural ecosystems.
Promoting curiosity and learning: Studying bees can be a fascinating and engaging way for children to learn about science and biology, as well as the interconnectedness of different organisms in nature.
Overall, learning about bee communities can help children develop a deeper understanding and appreciation for the natural world and our place within it, as well as inspire them to become responsible environmental stewards and appreciate the impacts of the circular bioeconomy.
The material is recommended to be applied - with adaptations - by preschoolers and elementary school students up to 12 years old. It is compatible with the kindergarten and elementary school programs in the fields of environment and natural sciences.

Development:

1. *Introduction to the world of bees.*

   Brainstorm class / discussion about bees and their products.

   Introduction to bees and their societies.

   Reference to pollination and its role

   [30 minutes]

   Videos that can be used as supporting material:

   - *BEE* | Animals For Kids | All Things Animal TV - YouTube
   - All About Insects for Children: Bees, Butterflies, Ladybugs, Ants and Flies for Kids - FreeSchool - YouTube

   Additionally one of the following: Whole Kids Foundation | 10 Buzzworthy Bee Movies and Videos

2. *Outdoor activity*

   The students in the school garden observe and record the flowers and insects with whatever means they have (eg: photographic, magnifying glass...) They can also collect flower blossoms and observe them in class. Note how the natural world is a bioeconomy.

   [60 minutes]

3. *Optional activity: Expert support (where possible)*

   Invite into the classroom or visit a beekeeper or other expert to talk about his/her work and show us a hive and his tools.

   Alternatively, watch a relevant video and discuss it.

   [45 minutes]

   Additional supporting material:

   - Teaching Kids About Honey Bees / Pineywoods Beekeepers

4. *Constructions*

   Using wax leaves or flowers, students make their own decorative structures.

   They can also see the value of the products created, to strengthen resources based on the circular bioeconomy.

[90 minutes]

Websites with photographic material for related constructions:

- http://1dim-olympic.att.sch.gr/?p=919
- https://gr.pinterest.com/egozdari/μέλισσα/

5. *Designing and creating a toy. Programming and guiding a floor robot (eg BEEBOT)*

   Using squared paper on which we have drawn squares the size of Beebot's "steps" and with drawings created by the children, make and play a snakes and ladders game with a bee theme and the movements emerge by programming the floor robot.

   [45 minutes]

   Indicative images: The wonderful world of the bee – 26 – 29 Acharnon Primary Schools (sch.gr)

6. *Students present what they made and learned.*

   The students present their work and participate in a musical movement activity that represents the movements of the bees. Discuss the role bees play in a circular bioeconomy.

   [45 minutes]

Conclusion:

The implementation of the program can offer children an experiential field of understanding and awareness of the importance of biodiversity, appreciation of the complex social structures that synergy and cooperation that develop even from the small bees, The application of exploratory activities inside and outside the classroom, teamwork, robot programming, design and construction are elements that attract children's interest and turn the learning process into a living space of interaction and learning. Finally, the connection with the products related to beekeeping highlights the value of the circular bioeconomy.

Reflection on Teaching & Learning:

Beyond the implementation of exploratory activities, the involvement of parents is decisive for the success of the program. For successful cooperation with parents, the following are recommended.

Parental engagement before implementation

Set Clear Goals:

The activity aims to highlight facts regarding the bees' community, cooperation and contribution to nature and humans. Since parents are valuable members of the educational community, their contribution and active participation in the activity is important to achieve the learning goals. Therefore, parents can be engaged in both the relative planning and the implementation process. Taking into account the learning goals as well as certain important criteria and limitations (i.e., the age and the educational background of the students, health issues, such as allergies to pollen, bee sting etc.), parents can cooperate with the teacher in order to define the final framework of implementation.

Before implementing the activity, the teacher introduces parents to the benefits of bee products and ensures that they have access to the necessary resources and materials (e.g., photographic, magnifying glasses, wax leaves, flowers, squared paper etc.). Some parents might be familiar with the context of the activity and able to help with the brainstorming process (e.g., explain the structure of the bees' society, display the stages of honey production) and/or the outdoor activity (e.g., presentation of different types of plants) and the construction (e.g., craft ideas, construction techniques). At this stage, parents are asked to mention any concerns they may have regarding the implementation and suggest additional ideas, such as partnering with local experts, environmental organisations, or beekeepers to provide further guidance and insights.

Parental engagement during implementation

Brainstorming:

Families are encouraged to describe how they use bee products in their everyday lives (e.g., putting honey in tea, baking with honey, using propolis-based cosmetics, having beeswax candles etc.). Parents could exchange recipes, also including the topic of cultural diversity in the bioeconomy project. At this stage, the teacher can foster discussions between parents and children about the activity and its broader implications. More specifically, these discussions can refer to real-world issues related

to bee populations and the challenges they face. Questions, curiosity and critical thinking are encouraged.

Hands-On Learning & Demonstrations:

Both parents and students are encouraged to actively participate during the outdoor activity and the construction stage. For example, in a bee-friendly garden activity, parents and students can work together to plant bee-friendly flowers and herbs, while discussing the importance of these plants in supporting bee populations. Parents can also experiment with using wax at home together, and children may bring their artwork to school and present it in a bee-themed art show. If possible, a part of the activity could take place at an observation hive, so that parents and children can witness bees in action, see the queen bee and learn about hive dynamics.

Explain the Science:

Parents who are familiar with the topic could help throughout the activity by explaining the scientific concepts involved and by discussing how bees play a crucial role in pollination, which is essential for the growth of many crops and the role they play in a bioeconomy.

Incorporate Art and Creativity:

Children and parents can create artwork related to bees or design informative posters about the bioeconomy. This allows for a well-rounded STEAM experience.

Follow-Up Activities:

The teacher can provide parents with follow-up activities or resources they can use at home to continue the learning experience. This could include recommended books, documentaries or citizen science projects related to bees and the circular bioeconomy.

Assessment for Learning:

Feedback and Reflection:

After the activity, parents and children are encouraged to reflect on what they've learned. The teacher may ask for feedback to improve future STEAM engagement events (e.g., did they like the activity? Was it an engaging activity for their children?

Would they recommend doing it again? Did they change their practice of buying honey or other bee products? Are they planning to eat more/less honey or source it from somewhere new as a result of the activity?).

The scenario was designed to engage students in learning about the importance of bees and other pollinators, as well as the challenges they face. We also wanted to encourage parents to participate in the learning process.

To assess the effectiveness of the scenario, we developed a questionnaire for parents. The questionnaire asks parents about their child's enjoyment of the activity, their own learning experiences, and their suggestions for improvement. The questionnaire also asks parents about the specific types of learning that they thought happened during the activity.

The results of the questionnaire will be used to improve the educational scenario for future students and parents. We will also share the results with other teachers and administrators to inform their practice.

The questionnaire is adapted to focus on specific aspects of the educational scenario, such as the brainstorming, hands-on learning, scientific explanations, or art and creativity components. The questionnaire has 20 questions (multiple choice, Likert scale, and open/close-ended):

Questionnaire for Parents

Dear parents,

Thank you for taking the time to complete this questionnaire. We are interested in hearing your feedback on the "Bees are the tireless workers of nature" educational scenario. Your responses will help us to improve the activity for future students and parents.

The questionnaire should take approximately 10 minutes to complete. All of your responses will be anonymous and will be used for improvement.

Here is the questionnaire:

Activity Feedback

1. *Did you enjoy the activity? (Multiple choice: Yes/No/Not sure)*

2. *Can you share a specific example of how your child was engaged during the activity.? (Likert scale: Strongly agree/Agree/Neutral/Disagree/Strongly disagree)*
3. *Would you recommend this activity to other parents? (Multiple choice: Yes/No/Not sure)*
4. *How well did the activity incorporate brainstorming? (Likert scale: Strongly agree/Agree/Neutral/Disagree/Strongly disagree)*
5. *How well did the activity incorporate hands-on learning? (Likert scale: Strongly agree/Agree/Neutral/Disagree/Strongly disagree)*
6. *How well did the activity incorporate scientific explanations? (Likert scale: Strongly agree/Agree/Neutral/Disagree/Strongly disagree)*
7. *How well did the activity incorporate art and creativity? (Likert scale: Strongly agree/Agree/Neutral/Disagree/Strongly disagree)*

Further Use of Knowledge

1. *Has your child changed their practice of requesting to buy honey or other bee products as a result of this activity? (Multiple choice: Yes/No/Not sure)*
2. *Has your child changed their eating habits as a result of this activity? (Multiple choice: Yes/No/Not sure)*
3. *If so, in what way? (Open-ended question)*
4. *What kind of learning do you think happened during this activity? (Multiple choice: Academic learning, social learning, emotional learning, all of the above)*

Additional Questions

1. *What did you like most about this activity? (Open-ended question)*
2. *What did you like least about this activity? (Open-ended question)*
3. *Do you have any suggestions for how we can improve this activity in the future? (Open-ended question)*
4. *How much time did you spend participating in the activity with your child? (Multiple choice: Less than 30 minutes/30-60 minutes/More than 60 minutes)*
5. *Did you learn anything new from the activity? (Multiple choice: Yes/No)*
6. *Do you feel more confident in supporting your child's learning about bees as a result of this activity? (Multiple choice: Yes/No/Not sure)*

7. *Did you enjoy participating in the activity with your child? (Multiple choice: Yes/No/Not sure)*
8. *Would you be interested in participating in other similar activities with your child in the future? (Multiple choice: Yes/No/Not sure)*
9. *Do you understand the concept of a circular bioeconomy? (Multiple choice: Yes/No/Not sure)*
10. *Do you have any suggestions for how we can improve this activity in the future? (Open-ended question)*

Thank you for your participation!

Celebrating Learning

Once you have collected the feedback from parents, you can use it to celebrate the learning that happened with the children. For example, you could share parents' feedback about what their children have learned, or you could invite parents and children to work together on a project related to sustainable Forestry or Bees and the circular bioeconomy.

Here are some ideas for celebrating learning together with students:

- *Create a bulletin board or display with the parents' comments about what their children learned.*
- *Have a discussion with the children about the things they learned and how they can use that knowledge to make a difference.*
- *Invite parents and children to work together on a project related to sustainable fishing / bees, such as creating a poster or planning a community event.*
- *Host a family-friendly event where parents and children can learn more about sustainable fishing / bees and how to make sustainable choices.*

By celebrating the learning that happened with parents and children, you can help to reinforce the importance of sustainable forestry and encourage everyone to take steps to protect our ecosystems.

Literature

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Links

- *BEE* | Animals For Kids | All Things Animal TV - YouTube
- All About Insects for Children: Bees, Butterflies, Ladybugs, Ants and Flies for Kids - FreeSchool - YouTube
- Whole Kids Foundation | 10 Buzzworthy Bee Movies and Videos
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- The wonderful world of the bee – 26 – 29 Acharnon Primary Schools (sch.gr)

National Curricula and Policy/SDG Connections:

- The lesson is connected with the SDG 12 and 15.

  Goal 12 is about ensuring sustainable consumption and production patterns, which is key to sustain the livelihoods of current and future generations.

  Goal 15 is about conserving life on land. It is to protect and restore terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and stop biodiversity loss.

- The scenario can be applied to Kindergarten and Primary (5-12 years old). It is compatible with the corresponding NCP of the Skills labs module and the Environmental Sciences, Science, and Art courses